3000 Series

MULTI-NET® II SWITCH

SET-UP AND ALIGNMENT

MULTI-NET® II 3000 SERIES SWITCH

SET-UP AND ALIGNMENT

EFJohnson®

October 2003
Supersedes: Part No. 001-3139-003/004; 5/99

MULTI-NET® II
3000 SERIES SWITCH
SETUP AND ALIGNMENT MANUAL

The EFJohnson Company, which was founded in 1923, provides wireless communication systems solutions for public safety, government, and commercial customers. The company designs, manufactures, and markets conventional and trunked radio systems, mobile and portable subscriber radios, repeaters, and Project 25 digital radio products. EFJohnson is a wholly owned subsidiary of EFJ, Inc.

SAFETY INFORMATION

The FCC has adopted a safety standard for human exposure to RF energy. Proper operation of this radio under normal conditions results in user exposure to RF energy below the Occupational Safety and Health Act and Federal Communication Commission limits.

WARNING

DO NOT allow the antenna to touch or come in very close proximity with the eyes, face, or any exposed body parts while the radio is transmitting.

DO NOT allow the antenna to come close to or touch, the eyes, face, or any exposed body parts while the radio is transmitting.

DO NOT operate the radio in explosive or flammable atmospheres. The transmitted radio energy could trigger blasting caps or cause an explosion.

DO NOT operate the radio without the proper antenna installed.

DO NOT operate the radio unless all radio frequency connectors are secure and any open connectors are properly terminated.

DO NOT allow children to operate or play with this equipment.

NOTE: The above warning list is not intended to include all hazards that may be encountered when using this radio.

This device complies with Part 15 of the FCC rules. Operation is subject to the condition that this device does not cause harmful interference. In addition, changes or modifications to this equipment not expressly approved by EFJohnson could void the user's authority to operate this equipment (FCC rules, 47CFR Part 15.19).

LAND MOBILE PRODUCT WARRANTY

The manufacturer's warranty statement for this product is available from your product supplier or from EFJohnson Company, 299 Johnson Avenue, Box 1249, Waseca, MN 56093-0514. Phone (507) 835-6222.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

LIST OF FIGURES

LIST OF FIGURES (CONT'D)

LIST OF TABLES

TABLE OF CONTENTS (CONT'D)

This page intentionally left blank.

SECTION 1 INTRODUCTION

1.1 SCOPE OF MANUAL

This manual describes the 3000 Series Switch modules and the alignment instructions for these modules. This manual is not intended to explain the entire Multi-Net® system, just the 3000-Series Switch segment. For parts list, schematic diagrams, and circuit board component layout information, refer to the 3000 Series Switch Service Manual, Part No. 001-3139-102. For more detailed information on the operation of the entire system, refer to Multi-Net Application Note, Part No. 009-3039-004CD.

1.2 DEFINITIONS

The following are brief definitions of terms and their usage as they are applied to the Switch.

1.2.1 TRUNKED SYSTEM

Refers to systems which pool multiple channels and use automatic switching so that all system users can access any repeater channel that is not in use. This results in minimum waiting to make a call.

1.2.2 LTR TRUNKED SYSTEM

The LTR® (Logic Trunked Radio) systems utilize a concept called trunking. Trunking makes all repeater channels on a system automatically available to the users. This is done by logic control system that continually monitors the system and updates the mobiles and repeaters using data messages. These data messages tell the mobiles which repeater channels are free and can be accessed if a call is to be made.

1.2.3 MULTI-NET TRUNKED SYSTEM

A trunking system similar to the LTR Trunked System, but which offers a number of additional and enhanced features.

1.2.4 CONVENTIONAL SYSTEM

Refers to systems which are licensed on a single repeater channel. Operation is similar to that of a community repeater because there is no automatic access to several repeater channels.

1.2.5 3000 SERIES SWITCH

The Switch connects several forms of communication together in a “Network” that allows communication between users in the system.

1.2.6 CALL PROCESSOR

The Call Processor controls the databases for the Switch and provides processing for certain types of calls within the system.

1.2.7 SYSTEM AND SUBSCRIBER MANAGER

The Switch along with the System and Subscriber Manager control the Multi-Net System. The System and Subscriber Manager is an IBM® PC or compatible computer that is running the Johnson management program. The System and Subscriber Manager is used by the System Manager to program, control and continuously monitor Switch operation. Refer to System and Subscriber Manager Operating Manual, Part No. 002-3139-078CD for more information.

1.2.8 REPEATER SITE

A location where one or more repeaters are housed. Trunked system repeaters are connected to the same high-speed data bus and are required to be located close together.

1.2.9 HOME REPEATER CHANNEL

All mobiles have one site repeater channel assigned as their “Home” repeater. The Home repeater and Group ID information identifies mobiles for standard dispatch calls.

1.2.10 STATUS REPEATER CHANNEL

The Status Repeater Channel is one repeater in a site that is designated to transmit update messages occurring on all other repeaters at the site. This repeater is available for voice traffic, but is not normally assigned as the Home repeater for any mobiles.

1.2.11 MONITOR REPEATER CHANNEL

This is the repeater channel that a mobile is currently monitoring for update messages. This repeater may be either the mobile's Home repeater or the site Status repeater. A special algorithm is used by the mobile to determine which is to be monitored. Generally, it is the last repeater that a valid data message was detected on.

1.2.12 TELEPHONE INTERCONNECT AND DATA TRANSMISSION

Mobile transceivers can be used to access the Public Switched Telephone Network (PSTN) on the 800 and 900 MHz bands. However, this interconnect operation must be on a secondary basis to dispatch operation. An exception is when the trunked system or channel is assigned exclusively to one user. In addition, interconnect calls in a private radio service must be related to the business activities of the particular user.

The actual connection to the public telephone system may take place at any location such as the repeater or a control station. The interconnect device can be separate or shared. Timers which limit the maximum length of transmissions are not required. However, the equipment must automatically turn off the transmitter within 3 minutes of the last transmission (except if another dispatch or interconnect call is initiated within this interval).

Data transmission and paging are also allowed on these frequencies. It also must be secondary to voice communication. Refer to applicable FCC rules and regulations for more information.

1.2.13 PUBLIC SWITCHED TELEPHONE NETWORK (PSTN)

If interconnect calls are to be placed by mobiles or landside users to mobiles, the Switch is connected to the Public Switched Telephone Network. The specific mobiles which can place calls and other interconnect parameters are determined by how the system manager programs the Call Processor and by the programming of each mobile transceiver.

1.2.14 PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX)

The system has the ability to connect to a PABX or PBX. This allows mobile originated calls to use the dial access codes and the least cost routing facility of the PABX/PBX.

SECTION 2 3000 SERIES SWITCH

2.1 INTRODUCTION

A Multi-Net radio system is a combination of several key elements that together make up a communication system. By using the basic elements of a Multi-Net system as building blocks, a Multi-Net system can be designed to meet the communication needs of almost any type of user. Elements of a Multi-Net system are:

- Backbone

  This consists of repeater site equipment including the links to the Switch.

- Control Consoles

  Used for dispatch operators.

- Switch

  Provides the interface between the Backbone and Control Consoles.

- RF Equipment

  Consists of mobiles, control stations, and handheld portables.

Each Multi-Net site is an independent trunking system that processes calls between RF units, maintains fleet partitioning, and provides priority access control. The backbone elements are interconnected by either microwave, fiber optics, RF links or private telephone lines equivalent to a 4-Wire voice grade phone circuit.

A Switch contains a Channel Interface Module (CIM) for each repeater it controls, a Telephone Interconnect Module (TIM) for each telephone line used for interconnect calls, an Intelligent Dispatch Module (IDM) or Multi-Net Console Module (MCM) for each dispatch console and others described in this section. A single Switch can control up to 30 repeater channels all at one site or divided among a combination of sites (e.g. 3-10 channel Localities on one Switch). Each repeater has an identical Switch interface/logic panel that performs the call processing for the channel. The Switch provides interface between the Locality equipment and the control consoles and directs all activity in Multi-Net site applications.

RF units in the coverage area of one repeater site can communicate with RF units in the coverage area of other repeater sites through the Switch. Where more than 30 channels are required, multiple Switches can be used with communication between them to direct calls. Wide area radio coverage is provided to allow a mobile to talk to another mobile using a repeater hundreds of miles away. That repeater may be part of the same Multi-Net system or another Multi-Net system with phone lines or some other type of link that provides the communication path.

One or more dispatch consoles can be connected to the Switch using; direct connection, phone lines, or some other type of link. Depending on the capabilities of the particular console, the dispatcher can perform such functions as; place calls to specific mobiles, place calls to other dispatchers, and make a patch between two mobiles.

2.2 ELEMENTS OF THE SWITCH

The Switch is a rack of modules. The rack may contain the following modules: (Table 2-1).

Table 2-1 SWITCH MODULES

NetNIM	Network Interface Module
CIM	Channel Interface Module
CCM	Conventional Channel Module
DCM	Dispatch Channel Module
DIM	Dispatch Interface Module
IDM	Intelligent Dispatch Module
SNM	System Network Module
TIM	Telephone Interface Module
VDM	Voter Diagnostics Module
PTM	Power Termination Module
VTM	Voice Tone Module
LEM	Logging Encoder Module
MAM	Multi-Net Acquisition Module
MCM	Multi-Net Console Module
CPM	Conventional Patch Module
WAM	Wide Area Module

2.3 SWITCH MODULES (ELEMENTS)

The Switch is constructed of different modules that interface from the Switch to external devices. The modules are:

- Channel Interface Module (CIM), to the Multi-Net or LTR System.
- Conventional Channel Module (CCM), to a Conventional Channel, channel side.
- Dispatch Interface Module (DIM), to the Dispatch Consoles.
- Telephone Interface Module (TIM), to the PSTN or a PABX.
- System Network Module (SNM), to other SNM, Switches.
- Network Interface Module (NetNIM), to the Call Processor.
- Dispatch Channel Module (DCM), to the Conventional Channel, network side.
- Voter Diagnostics Module (VDM), to the Voter system.
- Power Termination Module (PTM), provides fusing of power and termination for a shelf.
- Intelligent Dispatch Module (IDM), to the Tracer Series Dispatch Consoles.
- Logging Encoder Module (LEM), interface to a logging recorder.
- Multi-Net Acquisition Module (MAM), interface from the Switch to the VR-CM50 CRT Consoles for Tone Paging.
- Multi-Net Console Module (MCM), to VRCM-50 CRT Consoles.
- Conventional Patch Module (CPM), to dynamically patch a single conventional channel to a single trunked group.
- Wide Area Module (WAM), to other WAMs, Switches.

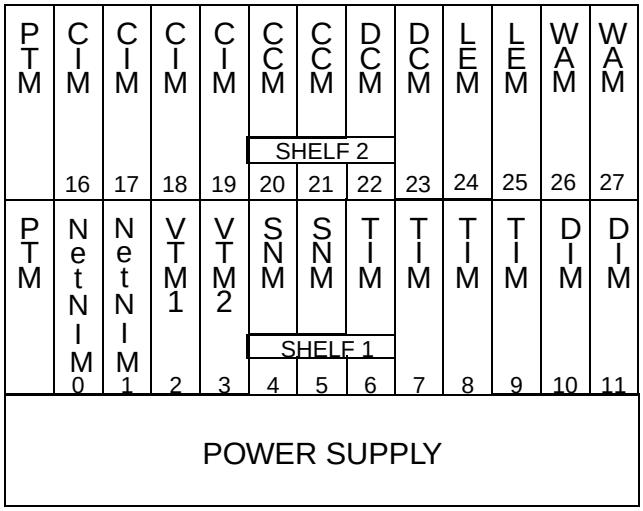


Figure 2-1 2-SHELF 3000 SERIES SWITCH

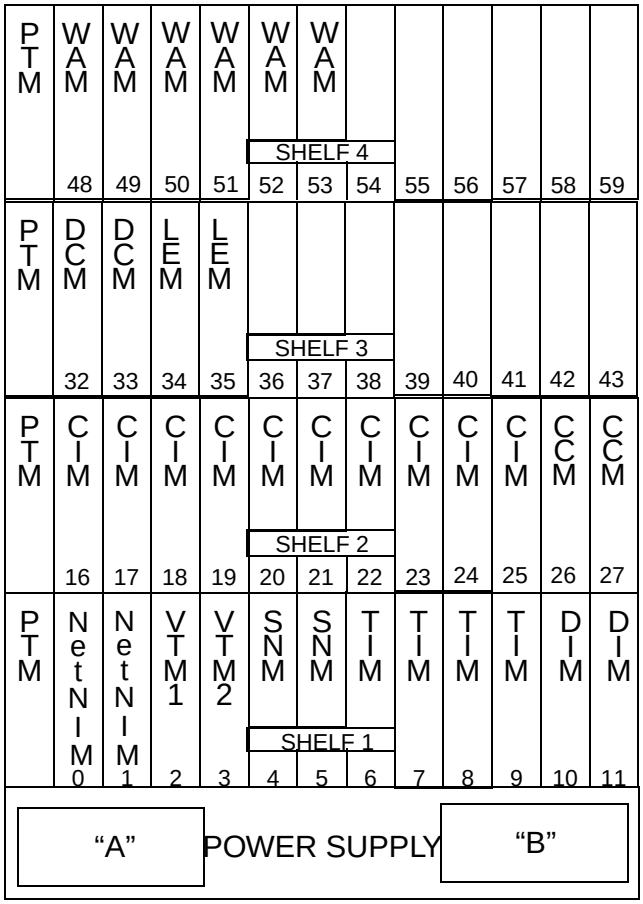


Figure 2-2 4-SHELF 3000 SERIES SWITCH

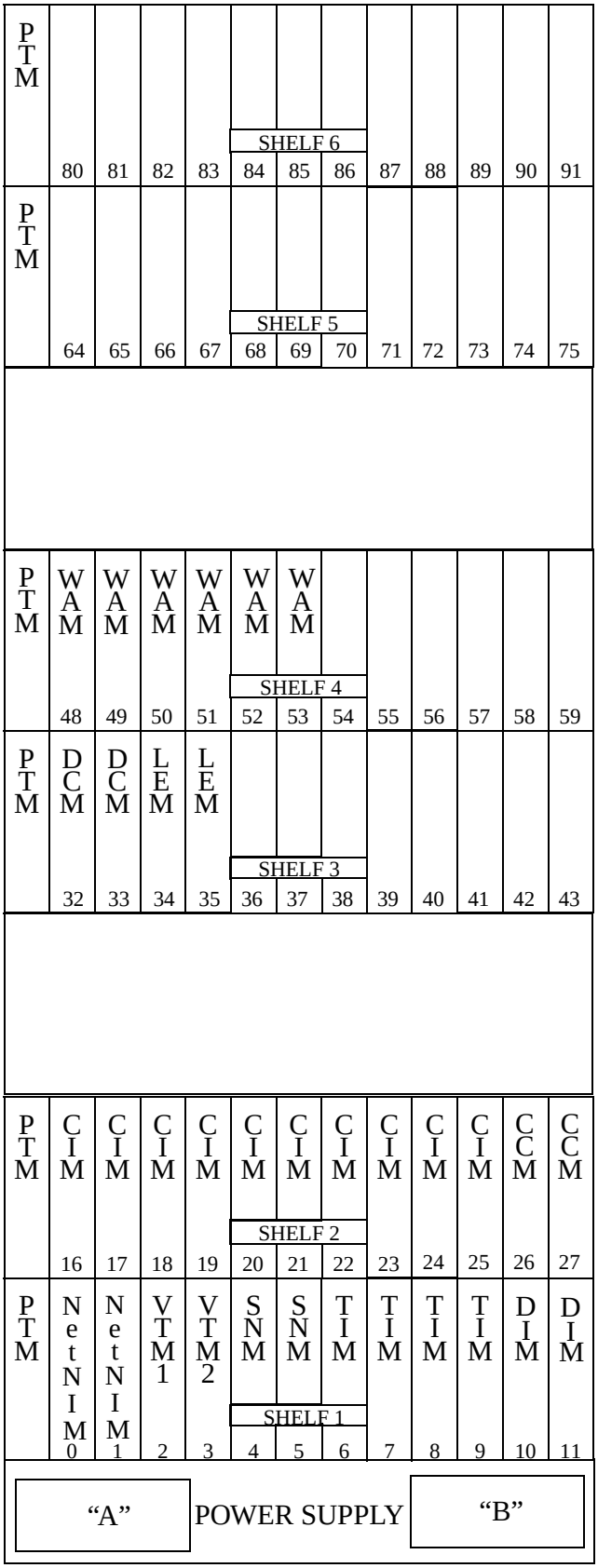


Figure 2-3 6-SHELF SWITCH RACK LAYOUT

PTM												
	112	113	114	115	SHELF 8 116	117	118	119	120	121	122	123
PTM												
	96	97	98	99	SHELF 7 100	101	102	103	104	105	106	107
PTM												
	80	81	82	83	SHELF 6 84	85	86	87	88	89	90	91
PTM												
	64	65	66	67	SHELF 5 68	69	70	71	72	73	74	75
PTM	WAM	WAM	WAM	WAM	WAM	WAM						
	48	49	50	51	SHELF 4 52	53	54	55	56	57	58	59
PTM	DCM	DCM	LEM	LEM					MCM	CPM1	CPM2	
	32	33	34	35	SHELF 3 36	37	38	39	40	41	42	43
PTM	CIM	CIM	CIM	CIM	CIM	CIM	CIM	CIM	CIM	CIM	CCM	CCM
	16	17	18	19	SHELF 2 20	21	22	23	24	25	26	27
PTM	NetNIM0	NetNIM1	VTM1	VTM2	SNM	SNM	TIM	TIM	TIM	TIM	DIM	DIM
			2	3	SHELF 1 4	5	6	7	8	9	10	11
	"A"				POWER SUPPLY				"B"			

Figure 2-4 8-SHELF SWITCH RACK SETUP

This page intentionally left blank.

SECTION 3 ARCHITECTURE

3.1 INTRODUCTION

The architecture of the Switch includes the modules or elements that make up the physical portions of the switch and the busses that carry data, control and voice information.

3.2 SWITCH INTERFACES

The main interfaces to the switch are as follows (see Figure 3-1):

a. Channel Interface to Multi-Net RF

b. Channel Interface to LTR Systems

c. Channel Interface to Conventional Channels

d. Interface with Dispatch Consoles

e. Interface with the Public Switched Telephone Network

f. Interface to other Switches

g. Interface to the Call Processor

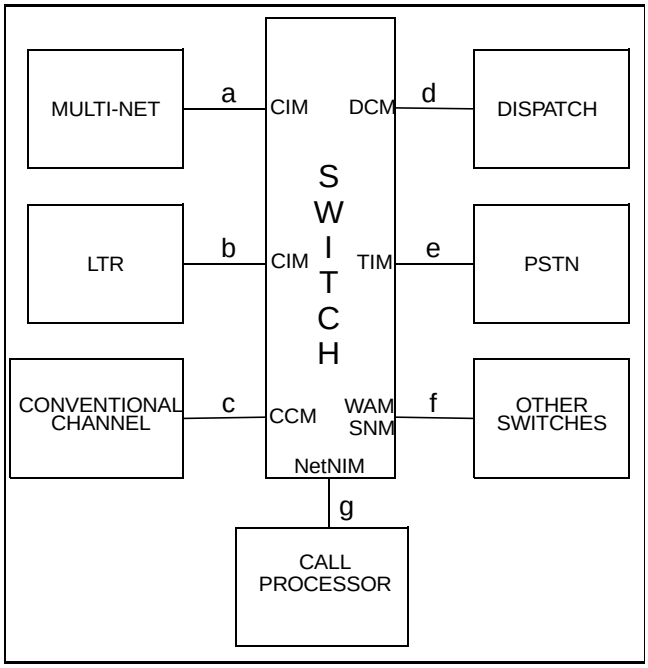


Figure 3-1 MULTI-NET SYSTEM SWITCH

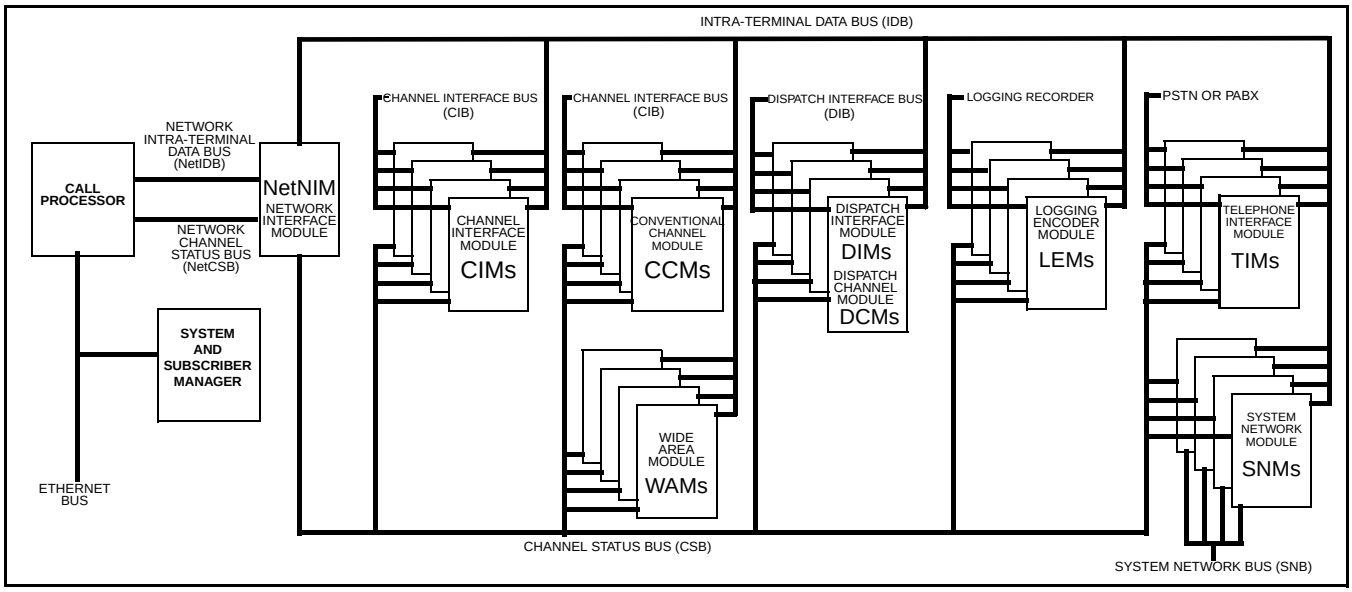


Figure 3-2 DATA BUSES

3.3 BUS STRUCTURE

The modules in the system are connected by various busses as described in the following sections.

3.3.1 DATA BUS

- Ethernet Bus

The Ethernet Bus is a broadcast networking technology that can use several different physical media, including twisted-pair cable and coaxial cable. The Ethernet bus connects multiple Call Processors and the System and Subscriber Manager together using TCP/IP for communication. This allows the Call Processors and the System and Subscriber Manager to pass information to keep each other up to date. The bus passes data for Subscriber Management, Subscriber Registration, and Switch Configuration Management.

- Network Intra-Terminal Data Bus (NetIDB)

A 19200 baud sync-escape protocol bus that passed information from the Call Processor to and from other modules via the NetNIM.

- Network Channel Status Bus (NetCSB)

A 19200 baud Sync-escape protocol bus that passes the CSB data to the Call Processor or external peripheral equipment via the NetNIM.

- Intra-Terminal Data Bus (IDB)

A 19200 baud sync-escape protocol bus that modules communicate on to pass control information to each other using high speed CSMA.

- Channel Status Bus (CSB)

A 19200 baud sync-escape protocol bus that passes channel status from channel modules to other system modules using high speed Carrier Sense Multiple Access (CSMA).

- Channel Interface Bus (CIB)

A 1200 baud sync-escape protocol bus that passes system channel control and status to and from the CIM.

- System Network Bus (SNB)

A 1200 baud sync-escape protocol bus that passes control and status between SNMs.

- PSTN or PABX

Connects to a PSTN (Public Switch Telephone Network) or a PABX (Private Automatic Branch Exchange) for outgoing and incoming telephone calls.

3.3.2 CONTROL BUS

The following are descriptions of control buses. Refer to Figure 3-3.

1. The IDB Idle/Collision line is a three level line that indicates if the line is idle, busy or collision occurred for the IDB communication process. This provides for high speed CSMA of the IDB.
2. The CSB Idle/Collision line is a three level line that indicates if the line is idle, busy or collision occurred for the CSB communication process. This provides high speed CSMA of the CSB.

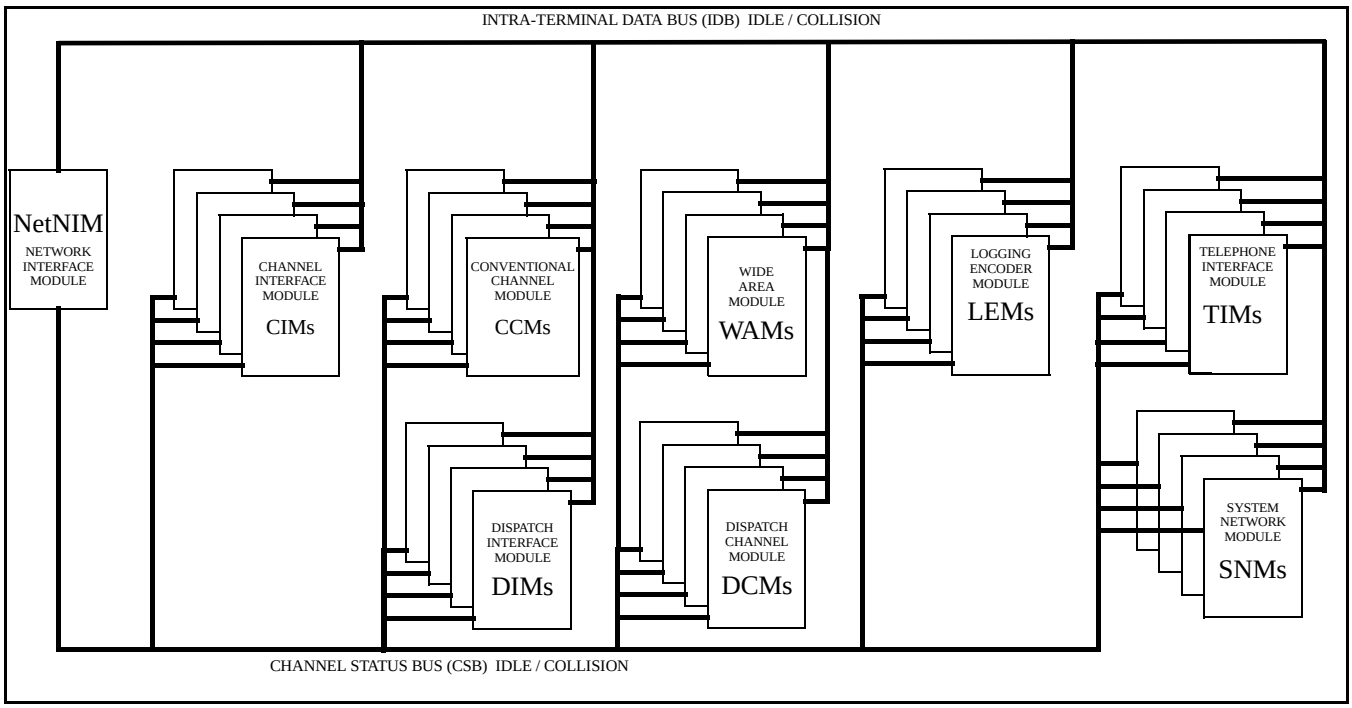


Figure 3-3 CONTROL BUSES

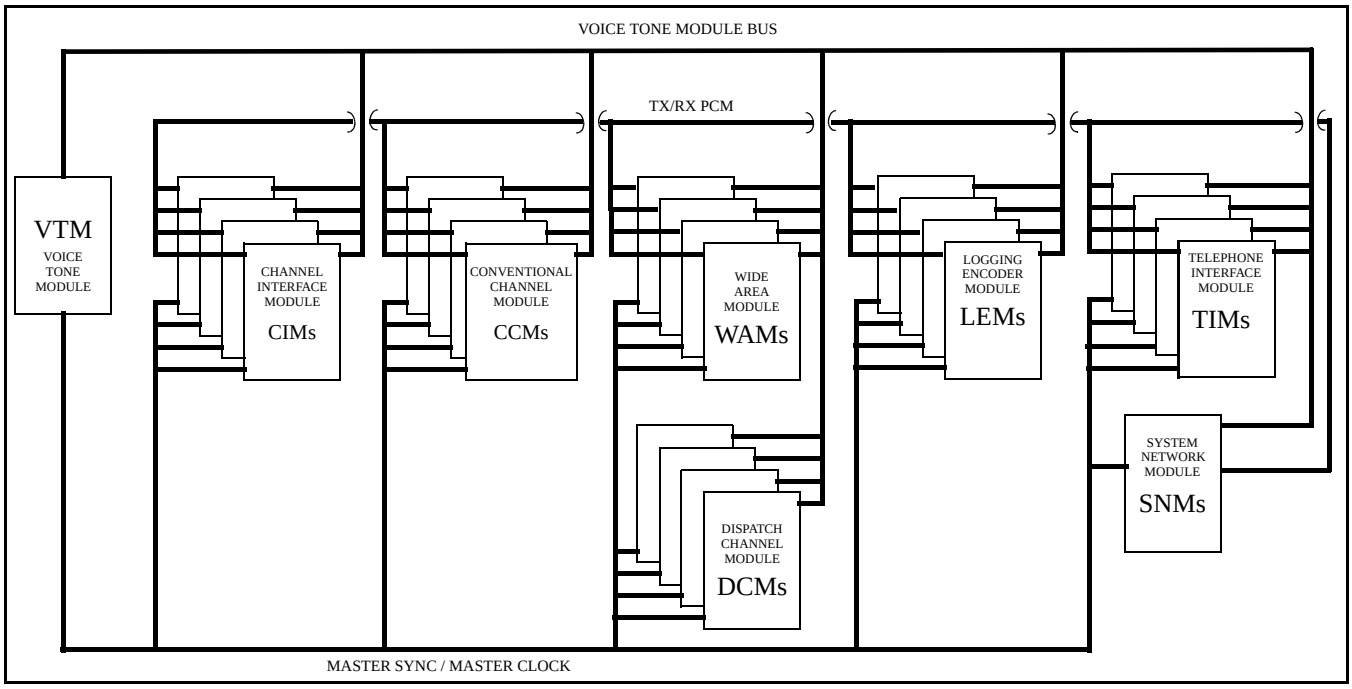


Figure 3-4 VOICE BUSES

3.3.3 VOICE BUS

The following are descriptions of voice buses. Refer to Figure 3-4.

1. VTM Bus

A 2.048 MHz Pulse Code Modulated (PCM) bus containing 32 slots of tones or voice the modules use to indicate call progress to an end user by means of audio information.

2. Tx PCM BUS

A 2.048 MHz Pulse Code Modulated (PCM) bus containing 32 slots. Audio received from the RF channel is transmitted on these slots by the channel modules and received by the other system modules.

3. Rx PCM Bus

A 2.048 MHz Pulse Code Modulated (PCM) bus contains 32 slots. Audio is transmitted from the other system modules to these slots and received by the channel modules to be transmitted on the RF channel.

4. Master Sync

Provides the synchronization signal for the PCM bus communication to begin the frame of 32 PCM slots.

5. Master Clock

Provides the 2.048 MHz clocking signal for the PCM buses.

SPECIFICATIONS

SYSTEM RACK

Dimensions	19" W x 31" D x 83.5" H
Environment	0° C to 50° C (32° F to 122° F) at 20% to 80% humidity (noncondensing)
Average Power	72 Modules x 5.1W ÷ 0.7 (efficiency) = 525W
Average Heat	525W x 3.6 = 1890 Btu/Hr
Weight	

MODULES

Dimensions	11.5" W x 8" H (8.6" including extractors)
Weight	0.95 lbs. (module only) 1.47 lbs. (module with Personality Card)
Environment	0° C to 50° C (32° F to 122° F) at 20% to 80% humidity (noncondensing)
Maximum Power and Current	+5V DC at 0.65A = 3.25W +12V DC at 0.1A = 1.2W -12V DC at 0.05A = 0.6W -48V DC at 0.03A = 1.44W (TIM-DID only) Total Power (less TIM-DID) = 5.05W Total Power (with TIM-DID) = 6.49W Maximum Power (with TIM-DID) = 8.0W

SYSTEM and SUBSCRIBER MANAGER

Computer	
Dimensions	21.3" W x 18.7" D x 6.4" H
Weight	45 pounds
Power and Current	115V AC at 8A or 230V AC at 5A
CRT	
Dimensions	14.1" W x 15.3" D x 14.7" H
Weight	35 pounds
Power and Current	120V AC at 2A or 240V AC at 1.5A
Environment	10° C to 40° C (50° F to 104° F) at 20% to 80% humidity (noncondensing)

This page intentionally left blank.

SECTION 4 SYSTEM RACK

4.1 TWO SHELF 3000 SERIES SWITCH

The system rack is a framework for modules that consists of up to two shelves with thirteen slots per shelf. In each shelf, twelve slots are for function modules and one slot is reserved for the power module. The power supplies for the shelves are located in the lower portion of the rack framework. The framework also provides support for interconnection wiring, routed between shelves, and external devices.

4.1.1 POWER CONSUMPTION

The following tables shows the average voltage, current and power for each supply voltage per card (based on loading of 24 cards).

Table 4-1 AVERAGE VOLTAGE/CURRENT/ POWER

Voltage	Current	Power
+5V DC	0.50A	2.50W
+12V DC	0.10A	1.20W
-12V DC	0.05A	0.60W
-48V DC	0.03A*	1.44W
	Total	5.74W
* DIDs only.		

Total watts including TIM-DID is 5.74W. Excluding the TIM-DID provides a total of 4.3W for normal modules. The total wattage of the terminal is found by multiplying the wattage of a module by the number of modules.

Total Watts x No. of Modules = Terminal Power

The wattage required by the power supply is found by dividing the total wattage of the terminal by the efficiency of the power supply (0.7).

Terminal Power ÷ 0.7 = Wattage of Power Supply

The BTUs per hour are found by multiplying a known value (3.6) by the wattage required by the power supply.

3.6 x Wattage of Power Supply = Btu/Hr.

EXAMPLE:

4.3W x 12 = 51.6W

51.6W ÷ 0.7 = 73.7W

3.6 x 73.7W = 265 Btu/Hr

4.1.2 EQUIPMENT REQUIRED

1. Digital Multimeter, voltmeter resolution to 0.001V.
2. Transmission test set, HP 3551A.
3. IBM NT compatible computer, with Call Processor Software.
4. Two CIMs (023-3039-035)

4.1.3 TWO SHELF POWER SUPPLY

The Power Supply has a 115/230V AC 50/60 Hz input and 4 continuous duty outputs as follows:

+5V DC 24A.
-5V DC 6A.
+12V DC 3A.
-12V DC 5A.

The power supply can handle 2-shelves and has the following connections:

4 separate +5V 2A connections.
2 separate -5V connections.
2 separate +12V connections.
2 separate -12V connections.
6 separate ground connections.

4.1.4 POWER SUPPLY REDUNDANT PLATE

The power supply drawer can be made redundant by the use of the redundant diode plate (PN 023-3039-553). The redundant plate allows two power supply drawers to share the load via diodes. One of the power supply drawers may be removed and the remaining drawer will supply the full load. (See Figure 4-10.)

Table 4-2 POWER SUPPLY CONNECTIONS

TB1	Wire No.	Color		From
Term 1	W1	Blk	AC (Hot)	Line
Term 2	W1	Wht	AC (Ntrl)	Line
Term 3	W1	Grn	AC (Gnd)	Line
TB2				
Term 1	W1	Red	+5V	F1
Term 2	W2	Red	+5V	F1
Term 3	W6	Blu	Gnd	Gnd
Term 4	NC			
Term 5	W7	Blu	Gnd	Gnd
Term 6	W4	Blu	+12V	F3
Term 7	W5	Wht	-12V	F4
Term 8	W3	Grn	-5V	F2
Term 9	W8	Blu	Gnd	Gnd

4.1.5 VOLTAGE ADJUSTMENTS

See Figure 4-10 for location of components and Table 4-2 for wire connections.

1. Connect a voltmeter to U1, pin 76 on an RVM (DO NOT use an extender card).
2. Adjust the +5V pot on the power supply for a reading of 5.1V.
3. If +5.1V cannot be obtained, change R84 to a 5.6k ohm 1/4W resistor.

4.1.6 REDUNDANT SUPPLY ADJUSTMENTS

See Figure 4-10 for location of components and Table 4-2 for wire connections.

1. Remove the AC voltage to one of the supplies.
2. Connect a voltmeter to U1, pin 76 on an RVM (DO NOT use an extender card).
3. Adjust the +5V pot for a reading of 5.1V. (If +5.1V cannot be obtained, change R84 to a 5.1k ohm 1/4W resistor.)
4. Connect a voltmeter to output of CR3 and verify that the -5V line is -4.8V to -5.2V. (If not, make R68 lower to raise voltage.)
5. Remove the AC voltage to the adjusted supply and connect AC voltage to the other power supply.
6. Connect a voltmeter to U1, pin 76 on an RVM (DO NOT use an extender card).
7. Adjust the +5V pot for a reading of 5.1V. (If +5.1V cannot be obtained, change R84 to a 5.1k ohm 1/4W resistor.)
8. Connect a voltmeter to output of CR3 and verify that the -5V line is -4.8V to -5.2V. (If not, make R68 lower to raise voltage.)

4.1.7 VERIFY FAN AIR FLOW DIRECTION

1. Connect the power cables to a 110V AC source.

2. Connect the Plus lead of the Fan Cable to Bus Bar D1-16.

3. Verify both power supplies are turned OFF. (Power Supply "A", is located on the left side at the bottom of the rack. Power Supply "B" is located on the right side at the bottom of the rack.)

4. Install both power supplies.

5. Turn Power Supply "A" on.

6. Verify that the Power On indicator is "ON" for Power Supply "A".

7. Verify that the air flow from the fan is to the outside.

4.1.8 VERIFY VOLTAGES ON POWER DISTRIBUTION CABLE

1. Verify voltages in Table 4-13 for the Power Termination Cables for Shelves 1-6.

2. Turn Power Supply "A" **OFF**.

Table 4-3 POWER DISTRIBUTION CABLE VOLTAGES

Pin	Color	
1	Green	-48V ±2V
2	Not Used	None
3	Black	Common
4	White	-12V ±1V
5	Not Used	None
6	Black	Common
7	Red	+5V +0.5/-0.1V
8	Not Used	+12V ±1V
9	Black	Common
10	Red	+5V +0.5/-0.1V
11	Blue	+12V ±1V
12	Black	Common
13	Red	+5V +0.5/-0.1V
14	Blue	+12V ±1V
15	Black	Common

4.1.9 SYSTEM TEST PROCEDURE

The following test procedure is for the Switch with six Power Termination Modules (PTMs), one Network Interface Module (NetNIM) and one Voice Termination Module (VTM).

1. Install all Power Termination Cables onto the backplane at mating connector P33.

2. Unplug all modules from the backplane card slots (leave unplugged modules in the card guides).

3. Verify the installation of the PCM W1 and W3 cables as shown in Table 4-14 (see Figure 4-5).

Table 4-4 PCM CABLE LOCATION

From	To
Shelf 1 - J25 Shelf 1 - J5 Shelf 1 - J6 Shelf 1 - J23 Shelf 1 - J24	Shelf 1 - J26 Shelf 2 - J3 Shelf 2 - J4 Shelf 2 - J25 Shelf 2 - J26
Shelf 2 - J5 Shelf 2 - J6 Shelf 2 - J23 Shelf 2 - J24	Shelf 3 - J3 Shelf 3 - J4 Shelf 3 - J25 Shelf 3 - J26

Table 4-5 S1 SWITCH SETTINGS

Shelf Number	Switch 1, Open Sections
1	ALL Closed
2	1
3	2
4	1,2
5	3
6	1,3
7	2,3
8	1,2,3
9	4
10	1,4
11	2,4
12	1,2,4
13	3,4
14	1,3,4
15	2,3,4
16	1,2,3,4
17	5
18	1,5

Shelf S1 Switch Settings

Verify switch settings of S1 in Table 4-15 for each shelf address (see Figure 4-5).

Backplane Switch Settings

Verify the backplane switch settings for S2 - S8 on each shelf are set with all sections closed.

PTM Switch Settings

Verify the switch settings of the Power Termination Module (PTM) are as follows:

S5, S7 all sections closed;
S6, S8 section 8 closed;
sections 1, 2, 3, 4, 5, 6, 7 open

Call Processor Connection To Switch

Verify the Call Processor connection to the System rack as follows:

1. NetIDB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J100 to Port 1 of the Call Processor computer.

2. NetCSB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J101 to Port 2 of the Call Processor computer.

3. Install a Power Termination Module in the first slot on the left side of each shelf.

4. Install the NetNIM in Shelf 1, Slot 0.

5. Turn "On" both Power Supplies, turn "On" the Call Processor and note that the four LEDs on each PTM card are "On".

   a. Verify that the Call Processor comes up in the Switch mode.

   b. Verify that the Call Processor displays the NetNIM’s clock status, "A Pass B Pass" in the Call Processor’s Device Activity window. If necessary, press the reset button S1on the NetNim to activate the clock status.)

PCM Bank Verification

PCM Bank Verification requires two Channel Interface Modules (CIMs).

1. *On both CIMs* place a patch cord from the top jack of J1 to the top jack of J2 (see Figure 10-1).

2. Close S1, sections 3-4; open sections 1-2 on each module.

3. *On both CIMs* set switch sections as follows:

Switch	Section
S3	1-2 open; 3-4 closed
S4	1-2 closed; 3-4 open
S5	1-2-3-4 closed.

4. Set one module for System Test "5" (S5-sections 1 and 3 open; sections 2 and 4 closed). Place this module in any slot on Shelf 1.

5. Set the second module for System Test "6". (S5-sections 2-3 open; 1-4 closed). Place this module in any slot on Shelf 2.

6. Loop Primary Tx PCM to the Primary Rx PCM by connecting a cable (023-3039-842) from Shelf 1-J3 to Shelf 1-J4 (see Figure 4-5).

7. The modules display an "A" if the PCM bank is good. Press S2 to reset the module if "A" is not displayed.

   - A failure on the primary displays a "1" on one or both modules.
   - A failure on the secondary displays a "2" on one or both modules.

8. After the PCM bank has proven good, force failures on both the primary and secondary as follows:

   Primary

   - Remove cables on Shelf 1, J5 and J6.
   - A "1" on both modules indicates a Primary failure.
   - Reconnect the cables.

   Secondary

   - Remove cables on Shelf 1, J23 and J24.
   - A "2" on both modules indicates a Secondary failure.
   - Reconnect the cables.
   - Remove the cable from Shelf 1, J3 to J4.

9. Remove CIMs from rack and patch cords from J1-J2.

VTM PCM Bank Verification

This requires the use of one CIM and one VTM1.

1. Verify the VTM1 card is in Shelf 1-slot 2.

2. On the VTM1 connect a Transmission Test Set to TP1 and TP2 (common).

3. On the VTM1 set S2 to select the 1020 Hz alignment tone. The tone should be heard in the Test Set speaker. Adjust the monitor volume as necessary.

4. Set the CIM for System Test "1".
   (S5, section 1 open; sections 2,3,4 closed.)

5. Place the module in any slot on Shelf 1.

6. Connect a Transmission Test Set with the common lead in CIM connector J13.

   - Verify -3 dBm ±0.5 dB at TP3 (adjust R83 if necessary).
   - Verify -12 dBm ±0.5 dB at J12 (adjust R44 if necessary).

7. Move the module to a slot on Shelf 2.

   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

8. Set the CIM to System Test "0".
   (S5 all sections closed.)

9. Remove the CIM from the rack.

4.1.10 FINAL CONFIGURATION VERIFICATION

NOTE: Make sure both power supplies are turned OFF.

1. Disconnect AC Power Cables from AC power source.

2. All PTMs should be installed and configured as follows:

Switch	Sections Closed	Sections Open
S5, S7	1 - 8	
S6, S8	8	1,2,3,4,5,6,7

3. Select one of the Backplane boards for measuring. Measurements can be made on any of the 64-pin connectors on the Backplane selected.

4. All measurements should be referenced to ground (pins 9, 10, 41 or 42) unless otherwise noted.

5. All test readings should be within 5% of the following specifications:

Pins	Ohms
16/48	37.5
17/49	37.5
18/50	37.5
19/51	75.0
20/52	37.5
21/53	37.5
22/54	100 (measured to +5V DC*)
23/55	37.5
24/56	100 (measured to +5V DC*)

* Pins 11, 12, 43 or 44.

6. On the top Backplane board, the following measurements should be referenced to ground (pins 9, 10, 41 or 42).

Center Pin of	Ohms
J5	37.5
J6	37.5
J23	19.2
J24	19.2

NOTE: The four readings should be ±1 ohm from the test specifications.

7. Test is completed.

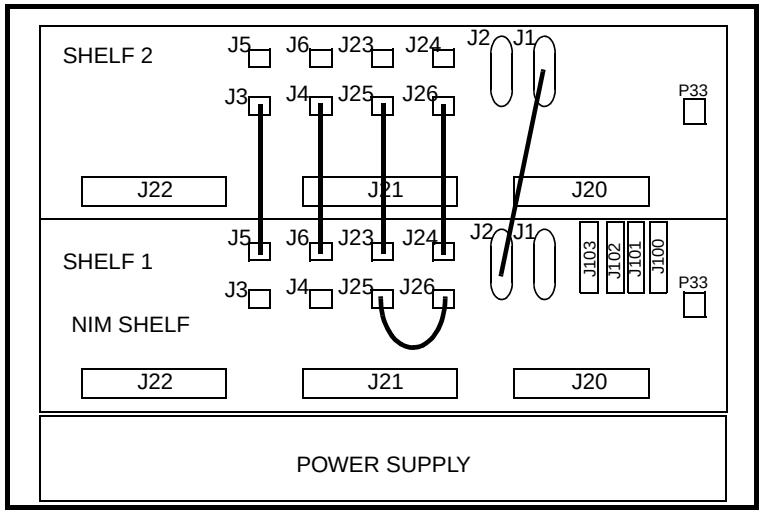


Figure 4-1 2-SHELF 3000 SERIES SWITCH BACKPLANE CABLES

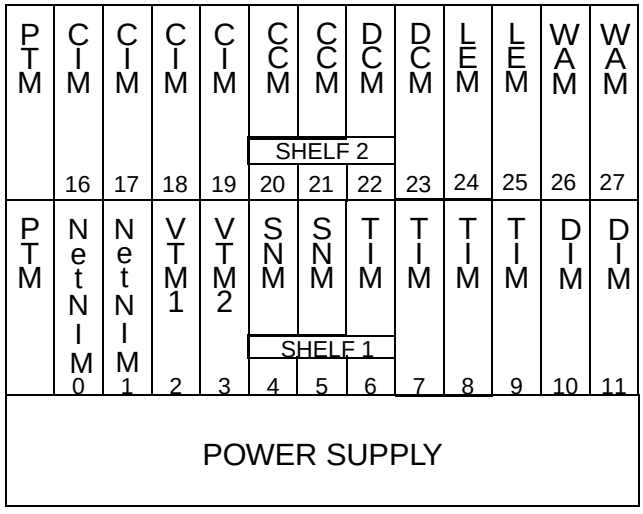


Figure 4-2 2-SHELF 3000 SERIES SWITCH SETUP

4.2 FOUR SHELF 3000 SERIES SWITCH

The system rack is a framework for modules that consists of up to 4-shelves with 13-slots per shelf. In each shelf, 12-slots are for function modules and 1-slot is reserved for the power module. The power supplies for the shelves are located in the lower portion of the rack framework. The framework also provides support for interconnection wiring, routed between shelves, and external devices.

4.2.1 POWER CONSUMPTION

The following tables shows the average voltage, current and power for each supply voltage per card (based on loading of 48 cards).

Table 4-6 AVERAGE VOLTAGE/CURRENT/ POWER

Voltage	Current	Power
+5V DC	0.50A	2.50W
+12V DC	0.10A	1.20W
-12V DC	0.05A	0.60W
-48V DC	0.03A*	1.44W
	Total	5.74W
* DIDs only.		

Total watts including TIM-DID is 5.74W. Excluding the TIM-DID provides a total of 4.3W for normal modules. The total wattage of the terminal is found by multiplying the wattage of a module by the number of modules.

Total Watts x No. of Modules = Terminal Power

The wattage required by the power supply is found by dividing the total wattage of the terminal by the efficiency of the power supply (0.7).

Terminal Power ÷ 0.7 = Wattage of Power Supply

The BTUs per hour are found by multiplying a known value (3.6) by the wattage required by the power supply.

3.6 x Wattage of Power Supply = Btu/Hr.

EXAMPLE:

4.3W x 48 = 206W

206W ÷ 0.7 = 295W

3.6 x 295W = 1,061 Btu/Hr

4.2.2 EQUIPMENT REQUIRED

- Digital Multimeter, voltmeter resolution to 0.001V.
- Transmission test set, HP 3551A.
- IBM NT compatible computer, with Call Processor Software.
- Two CIMs (023-3039-035).

4.2.3 4-SHELF POWER SUPPLY

The Power Supply has a 115/230V AC 50/60 Hz input and 4 continuous duty outputs as follows:

+5V DC 24A.
-5V DC 6A.
+12V DC 3A.
-12V DC 5A.

The power supply can handle 2-shelves and has the following connections:

4 separate +5V 2A connections.
2 separate -5V connections.
2 separate +12V connections.
2 separate -12V connections.
6 separate ground connections.

4.2.4 POWER SUPPLY REDUNDANT PLATE

The power supply drawer can be made redundant by the use of the redundant diode plate (PN 023-3039-553). The redundant plate allows two power supply drawers to share the load via diodes. One of the power supply drawers may be removed and the remaining drawer will supply the full load (see Figure 4-10).

Table 4-7 POWER SUPPLY CONNECTIONS

TB1	Wire No.	Color		From
Term 1	W1	Blk	AC (Hot)	Line
Term 2	W1	Wht	AC (Ntrl)	Line
Term 3	W1	Grn	AC (Gnd)	Line
TB2				
Term 1	W1	Red	+5V	F1
Term 2	W2	Red	+5V	F1
Term 3	W6	Blu	Gnd	Gnd
Term 4	NC			
Term 5	W7	Blu	Gnd	Gnd
Term 6	W4	Blu	+12V	F3
Term 7	W5	Wht	-12V	F4
Term 8	W3	Grn	-5V	F2
Term 9	W8	Blu	Gnd	Gnd

4.2.5 VOLTAGE ADJUSTMENTS

See Figure 4-10 for location of components and Table 4-2 for wire connections.

1. Connect a voltmeter to U1, pin 76 on an RVM (DO NOT use an extender card).

2. Adjust the +5V pot on the power supply for a reading of 5.1V.

3. If +5.1V cannot be obtained, change R84 to a 5.6k ohm 1/4W resistor.

4.2.6 REDUNDANT SUPPLY ADJUSTMENTS

See Figure 4-10 for location of components and Table 4-2 for wire connections.

1. Remove the AC voltage to one of the supplies.

2. Connect a voltmeter to U1, pin 76 on an RVM (DO NOT use an extender card).

3. Adjust the +5V pot for a reading of 5.1V. (If +5.1V cannot be obtained, change R84 to a 5.1k ohm 1/4W resistor.)

4. Connect a voltmeter to output of CR3 and verify that the -5V line is -4.8V to -5.2V. (If not, make R68 lower to raise voltage.)

5. Remove the AC voltage to the adjusted supply and connect AC voltage to the other power supply.

6. Connect a voltmeter to U1, pin 76 on an RVM (DO NOT use an extender card).

7. Adjust the +5V pot for a reading of 5.1V. (If +5.1V cannot be obtained, change R84 to a 5.1k ohm 1/4W resistor.)

8. Connect a voltmeter to output of CR3 and verify that the -5V line is -4.8V to -5.2V. (If not, make R68 lower to raise voltage.)

4.2.7 VERIFY FAN AIR FLOW DIRECTION

1. Connect the power cables to a 110V AC source.

2. Connect the Plus lead of the Fan Cable to Bus Bar D1-16.

3. Verify both power supplies are turned OFF. (Power Supply "A", is located on the left side at the bottom of the rack. Power Supply "B" is located on the right side at the bottom of the rack.)

4. Install both power supplies.

5. Turn Power Supply "A" on.

6. Verify that the Power On indicator is "ON" for Power Supply "A".

7. Verify that the air flow from the fan is to the outside.

4.2.8 VERIFY VOLTAGES ON POWER DISTRIBUTION CABLE

1. Verify voltages in Table 4-13 for the Power Termination Cables for Shelves 1-6.

2. Turn Power Supply “A” **OFF**.

Table 4-8 POWER DISTRIBUTION CABLE VOLTAGES

Pin	Color	
1	Green	-48V ±2V
2	Not Used	None
3	Black	Common
4	White	-12V ±1V
5	Not Used	None
6	Black	Common
7	Red	+5V +0.5/-0.1V
8	Not Used	+12V ±1V
9	Black	Common
10	Red	+5V +0.5/-0.1V
11	Blue	+12V ±1V
12	Black	Common
13	Red	+5V +0.5/-0.1V
14	Blue	+12V ±1V
15	Black	Common

Table 4-9 PCM CABLE LOCATION

From	To
Shelf 1 - J25 Shelf 1 - J5 Shelf 1 - J6 Shelf 1 - J23 Shelf 1 - J24	Shelf 1 - J26 Shelf 2 - J3 Shelf 2 - J4 Shelf 2 - J25 Shelf 2 - J26
Shelf 2 - J5 Shelf 2 - J6 Shelf 2 - J23 Shelf 2 - J24	Shelf 3 - J3 Shelf 3 - J4 Shelf 3 - J25 Shelf 3 - J26
Shelf 3 - J5 Shelf 3 - J6 Shelf 3 - J23 Shelf 3 - J24	Shelf 4 - J3 Shelf 4 - J4 Shelf 4 - J25 Shelf 4 - J26
Shelf 4 - J5 Shelf 4 - J6 Shelf 4 - J23 Shelf 4 - J24	Shelf 5 - J3 Shelf 5 - J4 Shelf 5 - J25 Shelf 5 - J26

4.2.9 SYSTEM TEST PROCEDURE

The following test procedure is for the Switch with six Power Termination Modules (PTMs), one Network Interface Module (NetNIM) and one Voice Termination Module (VTM).

1. Install all Power Termination Cables onto the back-plane at mating connector P33.

2. Unplug all modules from the backplane card slots (leave unplugged modules in the card guides).

3. Verify the installation of the PCM W1 and W3 cables as shown in Table 4-14 (see Figure 4-5).

Table 4-10 S1 SWITCH SETTINGS

Shelf Number	Switch 1, Open Sections
1	ALL Closed
2	1
3	2
4	1,2
5	3
6	1,3
7	2,3
8	1,2,3
9	4
10	1,4
11	2,4
12	1,2,4
13	3,4
14	1,3,4
15	2,3,4
16	1,2,3,4
17	5
18	1,5

Shelf S1 Switch Settings

Verify switch settings of S1 in Table 4-15 for each shelf address (see Figure 4-5).

Backplane Switch Settings

Verify the backplane switch settings for S2 - S8 on each shelf are set as follows:

Shelf 1-4 section 1 closed
sections 2,3,45,6,7,8 open

PTM Switch Settings

Verify the switch settings of the Power Termination Module (PTM) are as follows:

S5, S7	section 1 closed; sections 2,3,4,5,6,7,8 open
S6, S8	sections 1,2,6 closed; sections 3,4,5,7,8 open

Call Processor Connection To Switch

Verify the Call Processor connection to the System rack as follows:

1. NetIDB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J100 to Port 1 of the Call Processor computer.

2. NetCSB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J101 to Port 2 of the Call Processor computer.

3. Install a Power Termination Module in the first slot on the left side of each shelf.

4. Install the NetNIM in Shelf 1, Slot 0.

5. Turn "On" both Power Supplies, turn "On" the Call Processor and note that the four LEDs on each PTM card are "On".

   a. Verify that the Call Processor comes up in the Switch mode.

   b. Verify that the Call Processor displays the NetNIM’s clock status, "A Pass B Pass" in the Call Processor’s Device Activity window. If necessary, press the reset button S1on the NetNim to activate the clock status.)

PCM Bank Verification

PCM Bank Verification requires two Channel Interface Modules (CIMs).

1. *On both CIMs* place a patch cord from the top jack of J1 to the top jack of J2 (see Figure 10-1).

2. Close S1, sections 3-4; open sections 1-2 on each module.

3. *On both CIMs* set switch sections as follows:

Switch	**Section**
S3	1-2 open; 3-4 closed
S4	1-2 closed; 3-4 open
S5	1-2-3-4 closed.

4. Set one module for System Test "5" (S5-sections 1 and 3 open; sections 2 and 4 closed). Place this module in any slot on Shelf 1.

5. Set the second module for System Test "6". (S5-sections 2-3 open; 1-4 closed). Place this module in any slot on Shelf 4.

6. Loop Primary Tx PCM to the Primary Rx PCM by connecting a cable (023-3039-842) from Shelf 1-J3 to Shelf 1-J4 (see Figure 4-5).

7. The modules display an "A" if the PCM bank is good. Press S2 to reset the module if "A" is not displayed.

   - A failure on the primary displays a "1" on one or both modules.
   - A failure on the secondary displays a "2" on one or both modules.

8. Repeat this procedure by moving the module on Shelf 4 to Shelf 3. Reset both modules if “A” is not displayed.

9. Repeat this procedure by moving the module on Shelf 3 to Shelf 2. Reset both modules if "A" is not displayed.

10. After the PCM bank has proven good, force failures on both the primary and secondary as follows:

    Primary
    - Remove cables on Shelf 1, J5 and J6.
    - A "1" on both modules indicates a Primary failure.
    - Reconnect the cables.

    Secondary
    - Remove cables on Shelf 1, J23 and J24.
    - A "2" on both modules indicates a Secondary failure.
    - Reconnect the cables.
    - Remove the cable from Shelf 1, J3 to J4.

11. Remove CIMs from rack and patch cords from J1-J2.

VTM PCM Bank Verification

This requires the use of one CIM and one VTM1.

1. Verify the VTM1 card is in Shelf 1-slot 2.

2. *On the VTM1* connect a Transmission Test Set to TP1 and TP2 (common).

3. *On the VTM1* set S2 to select the 1020 Hz alignment tone. The tone should be heard in the Test Set speaker. Adjust the monitor volume as necessary.

4. Set the CIM for System Test "1".
(S5, section 1 open; sections 2,3,4 closed.)

5. Place the module in any slot on Shelf 1.

6. Connect a Transmission Test Set with the common lead in CIM connector J13.

   - Verify -3 dBm ±0.5 dB at TP3 (adjust R83 if necessary).
   - Verify -12 dBm ±0.5 dB at J12 (adjust R44 if necessary).

7. Move the module to a slot on Shelf 2.

   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

8. Move the module to a slot on Shelf 3.

   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

9. Move the module to a slot on Shelf 4.

   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

10. Set the CIM to System Test “0”.
(S5 all sections closed.)

11. Remove the CIM from the rack.

4.2.10 FINAL CONFIGURATION VERIFICATION

NOTE: Make sure both power supplies are turned OFF.

1. Disconnect AC Power Cables from AC power source.

2. All PTMs should be installed and configured as follows:

Switch	Sections Closed	Sections Open
S5, S7	2,5,6,7	1,3,4
S6, S8	2,5,6	1,3,4,7,8

3. Select one of the six Backplane boards for measuring. Measurements can be made on any of the 64-pin connectors on the Backplane selected.

4. All measurements should be referenced to ground (pins 9, 10, 41 or 42) unless otherwise noted.

5. All test readings should be within 5% of the following specifications:

Pins	Ohms
16/48	37.5
17/49	37.5
18/50	37.5
19/51	75.0
20/52	37.5
21/53	37.5
22/54	100 (measured to +5V DC*)
23/55	37.5
24/56	100 (measured to +5V DC*)

* Pins 11, 12, 43 or 44.

6. On the top Backplane board, the following measurements should be referenced to ground (pins 9, 10, 41 or 42).

Center Pin of	Ohms
J5	37.5
J6	37.5
J23	19.2
J24	19.2

NOTE: The four readings should be ±1 ohm from the test specifications.

7. Test is complete.

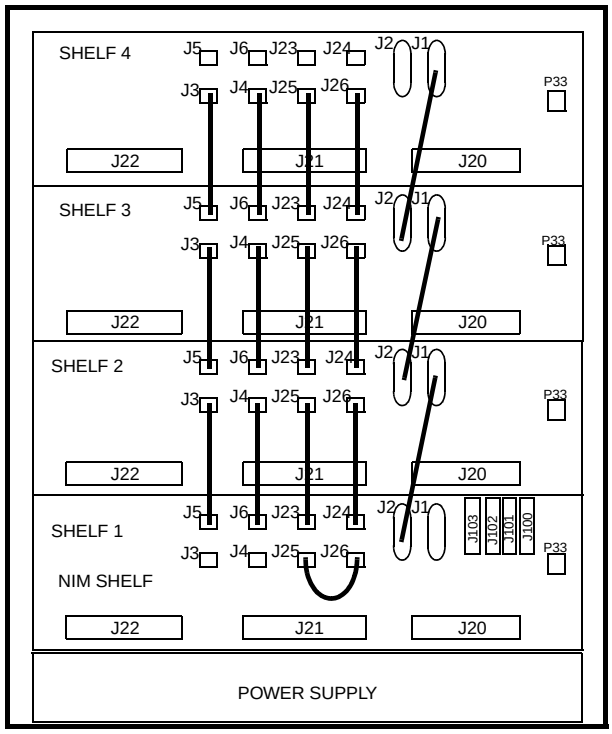


Figure 4-3 4-SHELF 3000 SERIES SWITCH BACKPLANE CABLES

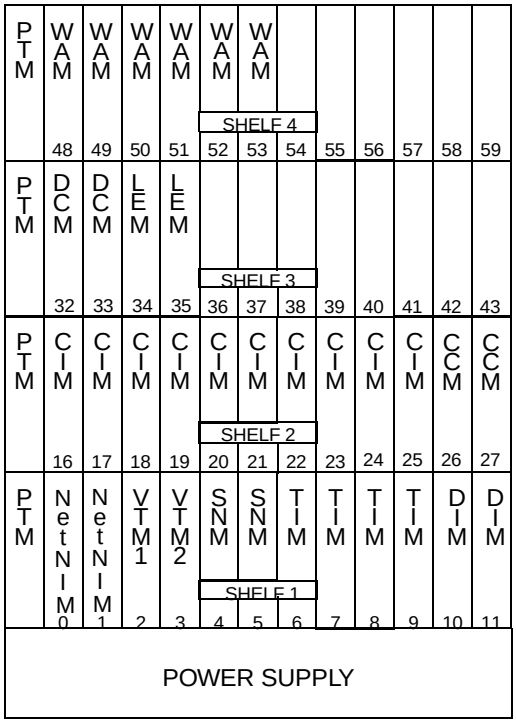


Figure 4-4 4-SHELF 3000 SERIES SWITCH SETUP

4.3 SIX SHELF 3000 SERIES SWITCH

The system rack is a framework for modules that consists of up to 6-shelves with 13-slots per shelf. In each shelf, 12-slots are for function modules and 1-slot is reserved for the power module. The power supplies for the shelves are located in the lower portion of the rack framework. The framework also provides support for interconnection wiring, routed between shelves, and external devices.

4.3.1 POWER CONSUMPTION

The following tables shows the average voltage, current and power for each supply voltage per card (based on loading of 72 cards).

Table 4-11 AVERAGE VOLTAGE/CURRENT/ POWER

Voltage	Current	Power
+5V DC	0.50A	2.50W
+12V DC	0.10A	1.20W
-12V DC	0.05A	0.60W
-48V DC	0.03A*	1.44W
	Total	5.74W
* DIDs only.		

Total watts including TIM-DID is 5.74W. Excluding the TIM-DID provides a total of 4.3W for normal modules. The total wattage of the terminal is found by multiplying the wattage of a module by the number of modules.

Total Watts x No. of Modules = Terminal Power

The wattage required by the power supply is found by dividing the total wattage of the terminal by the efficiency of the power supply (0.7).

Terminal Power ÷ 0.7 = Wattage of Power Supply

The BTUs per hour are found by multiplying a known value (3.6) by the wattage required by the power supply.

3.6 x Wattage of Power Supply = Btu/Hr.

EXAMPLE:

4.3W x 72 = 310W

310W ÷ 0.7 = 443W

3.6 x 443W = 1,595 Btu/Hr

4.3.2 EQUIPMENT REQUIRED

1. Digital Multimeter, voltmeter resolution to 0.001V.
2. Transmission test set, HP 3551A.
3. IBM NT compatible computer, with Call Processor Software.
4. Two CIMs (023-3039-035)

Table 4-12 BUS BAR RESISTANCE

Ohm Meter Lead Positions			Resistance in Ohms
From	To		
Bus Bar A1-A2	Chassis/Frame		Infinite
Bus Bar A1-A2	B1-B2	Black	0
Bus Bar A1-A2	C1-C2	Red	Infinite
Bus Bar A1-A2	D1	Blue	Infinite
Bus Bar A1-A2	E1	White	Infinite
Bus Bar A1-A2	F1	Green	Infinite
C1-C2 Red	D1	Blue	Infinite
D1-Blue	E1	White	Infinite
E1-White	F1	Green	Infinite

4.3.3 VERIFY RESISTANCE OF BUS BAR AND POWER SUPPLY LINES

1. Verify the Power Cables **are not** connected to a power source.

2. Verify the Power Supplies are not installed in the Power Supply shelf.

3. Measure the resistance from point-to-point and verify the resistance as shown in Table 4-12.

4.3.4 VERIFY COOLING FAN AIR FLOW DIRECTION

1. Connect the power cables to a 110V AC source.

2. Connect the Plus lead of the Fan Cable to Bus Bar D1-16.

3. Verify both power supplies are turned OFF. (Power Supply "A", is located on the left side at the bottom of the rack. Power Supply "B" is located on the right side at the bottom of the rack.)

4. Install both power supplies.

5. Turn Power Supply "A" on.

6. Verify that the Power On indicator is "ON" for Power Supply "A".

7. Verify that the air flow from the fan is to the outside.

4.3.5 VERIFY VOLTAGES ON POWER DISTRIBUTION CABLE

1. Verify voltages in Table 4-13 for the Power Termination Cables for Shelves 1-6.

2. Turn Power Supply "A" **OFF**.

Table 4-13 POWER DISTRIBUTION CABLE VOLTAGES

Pin	Color	
1	Green	-48V ±2V
2	Not Used	None
3	Black	Common
4	White	-12V ±1V
5	Not Used	None
6	Black	Common
7	Red	+5V +0.5/-0.1V
8	Not Used	+12V ±1V
9	Black	Common
10	Red	+5V +0.5/-0.1V
11	Blue	+12V ±1V
12	Black	Common
13	Red	+5V +0.5/-0.1V
14	Blue	+12V ±1V
15	Black	Common

4.3.6 SYSTEM TEST PROCEDURE

The following test procedure is for the Switch with six Power Termination Modules (PTMs), one Network Interface Module (NetNIM) and one Voice Termination Module (VTM).

1. Install all Power Termination Cables onto the backplane at mating connector P33.

2. Unplug all modules from the backplane card slots (leave unplugged modules in the card guides).

3. Verify the installation of the PCM W1 and W3 cables as shown in Table 4-14 (see Figure 4-5).

Table 4-14 PCM CABLE LOCATION

From	To
Shelf 1 - J25 Shelf 1 - J5 Shelf 1 - J6 Shelf 1 - J23 Shelf 1 - J24	Shelf 1 - J26 Shelf 2 - J3 Shelf 2 - J4 Shelf 2 - J25 Shelf 2 - J26
Shelf 2 - J5 Shelf 2 - J6 Shelf 2 - J23 Shelf 2 - J24	Shelf 3 - J3 Shelf 3 - J4 Shelf 3 - J25 Shelf 3 - J26
Shelf 3 - J5 Shelf 3 - J6 Shelf 3 - J23 Shelf 3 - J24	Shelf 4 - J3 Shelf 4 - J4 Shelf 4 - J25 Shelf 4 - J26
Shelf 4 - J5 Shelf 4 - J6 Shelf 4 - J23 Shelf 4 - J24	Shelf 5 - J3 Shelf 5 - J4 Shelf 5 - J25 Shelf 5 - J26
Shelf 5 - J5 Shelf 5 - J6 Shelf 5 - J23 Shelf 5 - J24	Shelf 6 - J3 Shelf 6 - J4 Shelf 6 - J25 Shelf 6 - J26

Table 4-15 S1 SWITCH SETTINGS

Shelf Number	Switch 1, Open Sections
1	ALL Closed
2	1
3	2
4	1,2
5	3
6	1,3
7	2,3
8	1,2,3
9	4
10	1,4
11	2,4
12	1,2,4
13	3,4
14	1,3,4
15	2,3,4
16	1,2,3,4
17	5
18	1,5

Shelf S1 Switch Settings

Verify switch settings of S1 in Table 4-15 for each shelf address (see Figure 4-5).

Backplane Switch Settings

Verify the backplane switch settings for S2 - S8 on each shelf are set as follows:

Shelf 1-6 sections 2,5,6,7,8 closed
sections 1,3,4 open

PTM Switch Settings

Verify the switch settings of the Power Termination Module (PTM) are as follows:

S5, S7 sections 2,5,6,7 closed;
sections 1,3,4 open
S6, S8 sections 2,5,6 closed;
sections 1,3,4,7,8 open

Call Processor Connection To Switch

Verify the Call Processor connection to the System rack as follows:

1. NetIDB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J100 to Port 1 of the Call Processor computer.

2. NetCSB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J101 to Port 2 of the Call Processor computer.

3. Install a Power Termination Module in the first slot on the left side of each shelf.

4. Install the NetNIM in Shelf 1, Slot 0.

5. Turn "On" both Power Supplies, turn "On" the Call Processor and note that the four LEDs on each PTM card are "On".

   a. Verify that the Call Processor comes up in the Switch mode.

   b. Verify that the Call Processor displays the NetNIM’s clock status, “A Pass B Pass” in the Call

Processor's Device Activity window. If necessary, press the reset button S1on the NetNim to activate the clock status.)

PCM Bank Verification

PCM Bank Verification requires two Channel Interface Modules (CIMs).

1. On both CIMs place a patch cord from the top jack of J1 to the top jack of J2 (see Figure 10-1).

2. Close S1, sections 3-4; open sections 1-2 on each module.

3. On both CIMs set switch sections as follows:

Switch	Section
S3	1-2 open; 3-4 closed
S4	1-2 closed; 3-4 open
S5	1-2-3-4 closed.

4. Set one module for System Test "5" (S5-sections 1 and 3 open; sections 2 and 4 closed). Place this module in any slot on Shelf 1.

5. Set the second module for System Test "6". (S5-sections 2-3 open; 1-4 closed). Place this module in any slot on Shelf 6.

6. Loop Primary Tx PCM to the Primary Rx PCM by connecting a cable (023-3039-842) from Shelf 1-J3 to Shelf 1-J4 (see Figure 4-5).

7. The modules display an "A" if the PCM bank is good. Press S2 to reset the module if "A" is not displayed.

   - A failure on the primary displays a "1" on one or both modules.
   - A failure on the secondary displays a "2" on one or both modules.

8. Repeat this procedure by moving the module on Shelf 6 to Shelf 5. Reset both modules if "A" is not displayed.

9. Repeat this procedure by moving the module on Shelf 5 to Shelf 4. Reset both modules if "A" is not displayed.

10. Repeat this procedure by moving the module on Shelf 4 to Shelf 3. Reset both modules if "A" is not displayed.

11. Repeat this procedure by moving the module on Shelf 3 to Shelf 2. Reset both modules if "A" is not displayed.

12. After the PCM bank has proven good, force failures on both the primary and secondary as follows:

    Primary
    - Remove cables on Shelf 1, J5 and J6.
    - A "1" on both modules indicates a Primary failure.
    - Reconnect the cables.

    Secondary
    - Remove cables on Shelf 1, J23 and J24.
    - A "2" on both modules indicates a Secondary failure.
    - Reconnect the cables.
    - Remove the cable from Shelf 1, J3 to J4.

13. Remove CIMs from rack and patch cords from J1-J2.

VTM PCM Bank Verification

This requires the use of one CIM and one VTM1.

1. Verify the VTM1 card is in Shelf 1-slot 2.

2. On the VTM1 connect a Transmission Test Set to TP1 and TP2 (common).

3. On the VTM1 set S2 to select the 1020 Hz alignment tone. The tone should be heard in the Test Set speaker. Adjust the monitor volume as necessary.

4. Set the CIM for System Test "1". (S5, section 1 open; sections 2,3,4 closed.)

5. Place the module in any slot on Shelf 1.

6. Connect a Transmission Test Set with the common lead in CIM connector J13.

   - Verify -3 dBm ±0.5 dB at TP3 (adjust R83 if necessary).
   - Verify -12 dBm ±0.5 dB at J12 (adjust R44 if necessary).

7. Move the module to a slot on Shelf 2.

   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

8. Move the module to a slot on Shelf 3.

   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

9. Move the module to a slot on Shelf 4.

   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

10. Move the module to a slot on Shelf 5.

    - Verify -3 dBm ±0.5 dB at TP3.
    - Verify -12 dBm ±0.5 dB at J12

11. Move the module to a slot on Shelf 6.

    - Verify -3 dBm ±0.5 dB at TP3.
    - Verify -12 dBm ±0.5 dB at J12

12. Set the CIM to System Test "0". (S5 all sections closed.)

13. Remove the CIM from the rack.

4.3.7 FINAL CONFIGURATION VERIFICATION

NOTE: Make sure both power supplies are turned OFF.

1. Disconnect AC Power Cables from AC power source.

2. All PTMs should be installed and configured as follows:

Switch	Sections Closed	Sections Open
S5, S7	2,5,6,7	1,3,4
S6, S8	2,5,6	1,3,4,7,8

3. Select one of the six Backplane boards for measuring. Measurements can be made on any of the 64-pin connectors on the Backplane selected.

4. All measurements should be referenced to ground (pins 9, 10, 41 or 42) unless otherwise noted.

5. All test readings should be within 5% of the following specifications:

Pins	Ohms
16/48	37.5
17/49	37.5
18/50	37.5
19/51	75.0
20/52	37.5
21/53	37.5
22/54	100 (measured to +5V DC*)
23/55	37.5
24/56	100 (measured to +5V DC*)

   * Pins 11, 12, 43 or 44.

6. On the top Backplane board, the following measurements should be referenced to ground (pins 9, 10, 41 or 42).

Center Pin of	Ohms
J5	37.5
J6	37.5
J23	19.2
J24	19.2

   NOTE: The four readings should be ±1 ohm from the test specifications.

7. Test is complete.

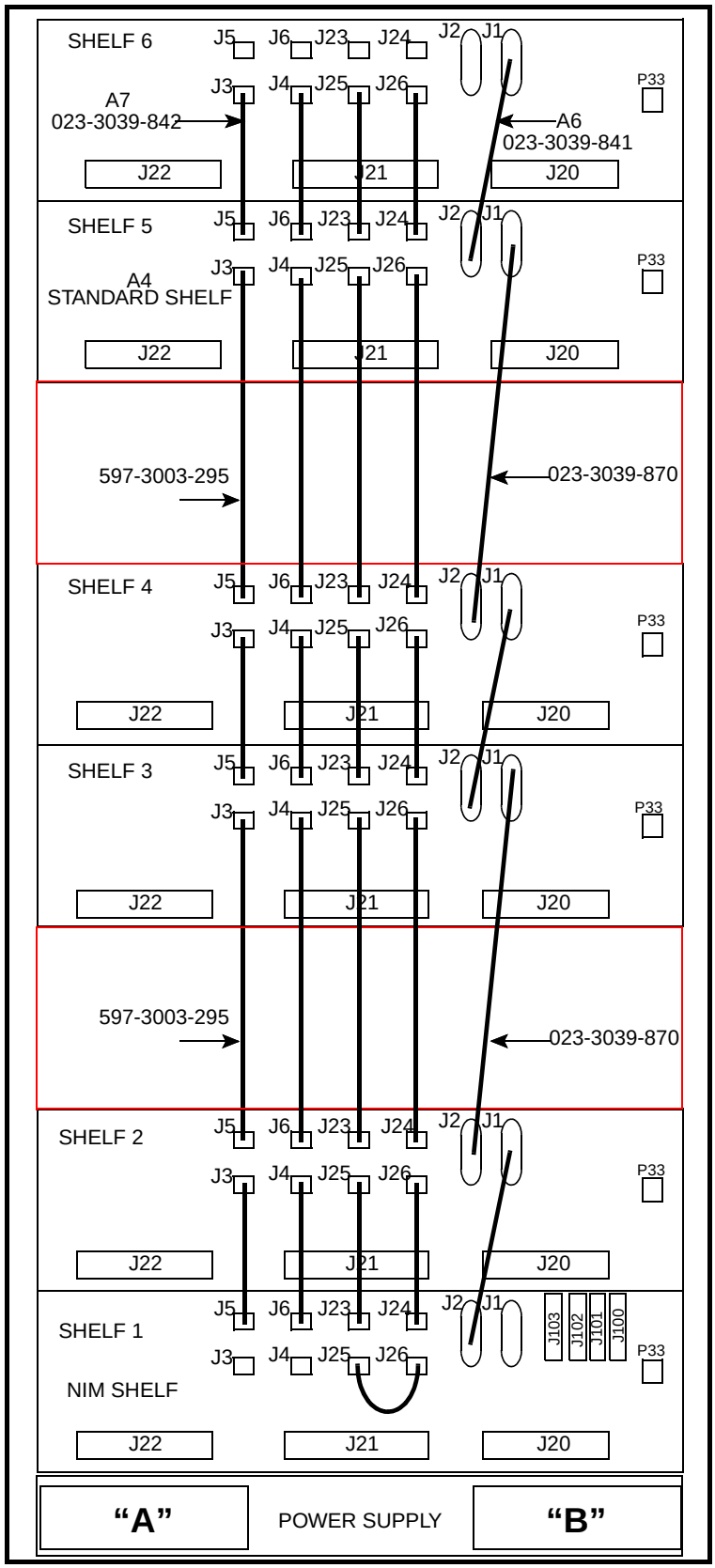


Figure 4-5 SIX SHELF 3000 SERIES SWITCH BACKPLANE CABLES

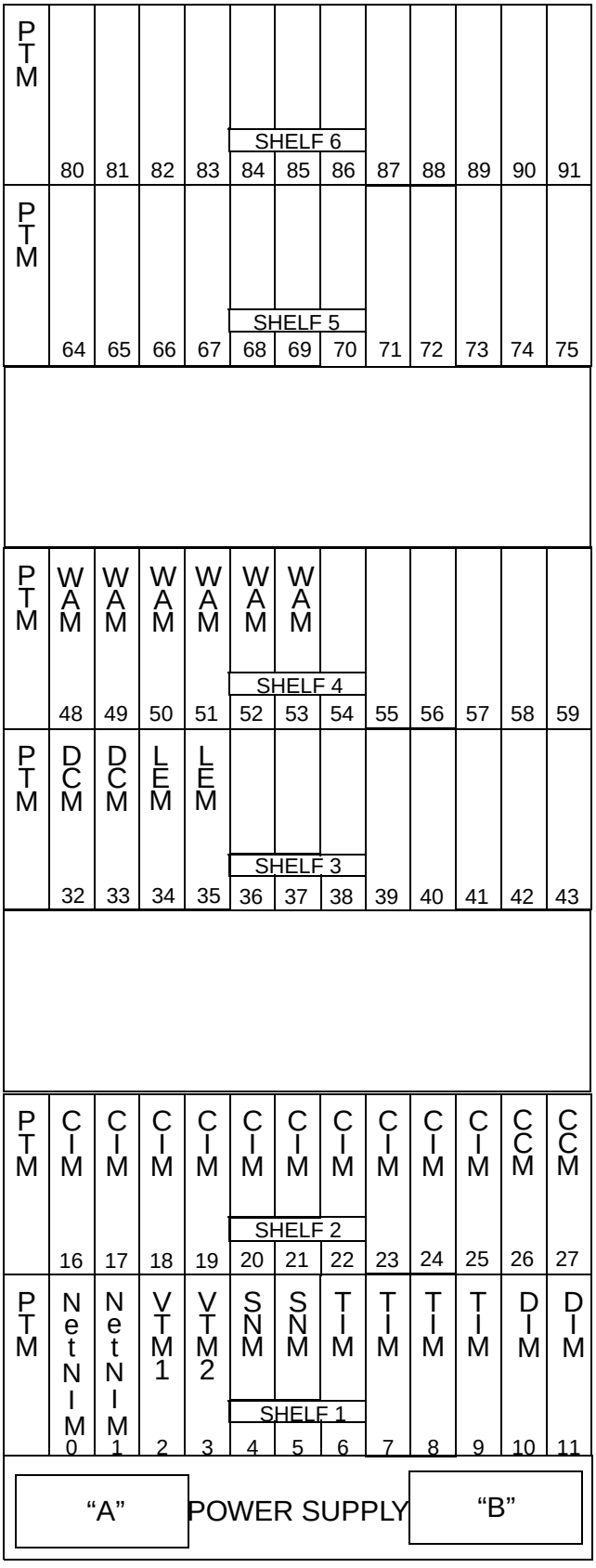


Figure 4-6 SIX SHELF 3000 SERIES SWITCH SETUP

4.4 EIGHT SHELF 3000 SERIES SWITCH

The system rack is a framework for modules that consists of up to 8-shelves with 13-slots per shelf. In each shelf, 12-slots are for function modules and 1-slot is reserved for the power module. The power supplies for the shelves are located in the lower portion of the rack framework. The framework also provides support for interconnection wiring, routed between shelves, and external devices.

4.4.1 POWER CONSUMPTION

The following tables shows the average voltage, current and power for each supply voltage per card (based on loading of 96 cards).

Table 4-16 AVERAGE VOLTAGE/CURRENT/ POWER

Voltage	Current	Power
+5V DC	0.50A	2.50W
+12V DC	0.10A	1.20W
-12V DC	0.05A	0.60W
-48V DC	0.03A*	1.44W
	Total	5.74W
* DIDs only.		

Total watts including TIM-DID is 5.74W. Excluding the TIM-DID provides a total of 4.3W for normal modules. The total wattage of the terminal is found by multiplying the wattage of a module by the number of modules.

Total Watts x No. of Modules = Terminal Power

The wattage required by the power supply is found by dividing the total wattage of the terminal by the efficiency of the power supply (0.7).

Terminal Power ÷ 0.7 = Wattage of Power Supply

The BTUs per hour are found by multiplying a known value (3.6) by the wattage required by the power supply.

3.6 x Wattage of Power Supply = Btu/Hr.

EXAMPLE:

4.3W x 96 = 413W

413W ÷ 0.7 = 590W

3.6 x 590W = 2,123 Btu/Hr

4.4.2 EQUIPMENT REQUIRED

- Digital Multimeter, voltmeter resolution to 0.001V.
- Transmission test set, HP 3551A.
- IBM NT compatible computer, with NetSMM Call Processing Software.
- Two CIMs (023-3039-035)

4.4.3 VERIFY RESISTANCE OF BUS BAR AND POWER SUPPLY LINES

1. Verify the Power Cables ***are not*** connected to a power source.

2. Verify the Power Supplies are not installed in the Power Supply shelf.

3. Measure the resistance from point-to-point and verify the resistance as shown in Table 4-17.

Table 4-17 BUS BAR RESISTANCE

Ohm Meter Lead Positions			Resistance in Ohms
From	To		
Bus Bar A1-A2	Chassis/Frame		Infinite
Bus Bar A1-A2	B1-B2	Black	0
Bus Bar A1-A2	C1-C2	Red	Infinite
Bus Bar A1-A2	D1	Blue	Infinite
Bus Bar A1-A2	E1	White	Infinite
Bus Bar A1-A2	F1	Green	Infinite
C1-C2 Red	D1	Blue	Infinite
D1-Blue	E1	White	Infinite
E1-White	F1	Green	Infinite

4.4.4 VERIFY COOLING FAN AIR FLOW DIRECTION

1. Connect the power cables to a 110V AC source.

2. Connect the Plus lead of the Fan Cable to Bus Bar D1-16.

3. Verify both power supplies are turned OFF. (Power Supply "A", is located on the left side at the bottom of the rack. Power Supply "B" is located on the right side at the bottom of the rack.)

4. Install both power supplies.

5. Turn Power Supply "A" on.

6. Verify that the Power On indicator is "ON" for Power Supply "A".

7. Verify that the air flow from the fan is to the outside.

Table 4-18 POWER DISTRIBUTION CABLE VOLTAGES

Pin	Color	
1	Green	-48V ±2V
2	Not Used	None
3	Black	Common
4	White	-12V ±1V
5	Not Used	None
6	Black	Common
7	Red	+5V +0.5/-0.1V
8	Not Used	+12V ±1V
9	Black	Common
10	Red	+5V +0.5/-0.1V
11	Blue	+12V ±1V
12	Black	Common
13	Red	+5V +0.5/-0.1V
14	Blue	+12V ±1V
15	Black	Common

4.4.5 VERIFY VOLTAGES ON POWER DISTRIBUTION CABLE

1. Verify voltages in Table 4-18 for the Power Termination Cables for Shelves 1-6.

2. Turn Power Supply "A" **OFF**.

4.4.6 SYSTEM TEST PROCEDURE

The following test procedure is for the 3000 Series Switch with:

8 - Power Termination Modules (PTMs)
1 - Network Interface Module (NetNIM)
1 - Voice Termination Module (VTM).

1. Install all Power Termination Cables onto the back-plane at mating connector P33.

2. Unplug all modules from the backplane card slots (leave unplugged modules in the card guides).

3. Verify the installation of the PCM W1 and W3 cables as shown in Table 4-19 (see Figure 4-7).

Table 4-19 PCM CABLE LOCATION

From	To
Shelf 1 - J25 Shelf 1 - J5 Shelf 1 - J6 Shelf 1 - J23 Shelf 1 - J24	Shelf 1 - J26 Shelf 2 - J3 Shelf 2 - J4 Shelf 2 - J25 Shelf 2 - J26
Shelf 2 - J5 Shelf 2 - J6 Shelf 2 - J23 Shelf 2 - J24	Shelf 3 - J3 Shelf 3 - J4 Shelf 3 - J25 Shelf 3 - J26
Shelf 3 - J5 Shelf 3 - J6 Shelf 3 - J23 Shelf 3 - J24	Shelf 4 - J3 Shelf 4 - J4 Shelf 4 - J25 Shelf 4 - J26
Shelf 4 - J5 Shelf 4 - J6 Shelf 4 - J23 Shelf 4 - J24	Shelf 5 - J3 Shelf 5 - J4 Shelf 5 - J25 Shelf 5 - J26
Shelf 5 - J5 Shelf 5 - J6 Shelf 5 - J23 Shelf 5 - J24	Shelf 6 - J3 Shelf 6 - J4 Shelf 6 - J25 Shelf 6 - J26
Shelf 6 - J5 Shelf 6 - J6 Shelf 6 - J23 Shelf 6 - J24	Shelf 7 - J3 Shelf 7 - J4 Shelf 7 - J25 Shelf 7 - J26
Shelf 7 - J5 Shelf 7 - J6 Shelf 7 - J23 Shelf 7 - J24	Shelf 8 - J3 Shelf 8 - J4 Shelf 8 - J25 Shelf 8 - J26

Shelf S1 Switch Settings

Verify switch settings of S1 in Table 4-20 for each shelf address (see Figure 4-8).

Table 4-20 S1 SWITCH SETTINGS

Shelf Number	Switch 1, Open Sections
1	ALL Closed
2	1
3	2
4	1,2
5	3
6	1,3
7	2,3
8	1,2,3
9	4
10	1,4
11	2,4
12	1,2,4
13	3,4
14	1,3,4
15	2,3,4
16	1,2,3,4
17	5
18	1,5
19	2,5
20	1,2,5
21	3,5
22	1,3,5
23	2,3,5
24	1,2,3,5

Backplane Switch Settings

Verify the backplane switch settings for S2 - S8 on each shelf are set as follows:

Shelf 1-8 Sections 3,4,5,6,8 closed
Sections 1,2,7 open

PTM Switch Settings

Verify the switch settings of the Power Termination Module (PTM) are as follows:

S5, S7 Sections 3,4,5,6,7 closed;
Sections 1,2 open
S6, S8 Sections 2,3,6 closed;
Sections 1,4,5,7,8 open

Call Processor Connection To Switch

Verify the Call Processor connection to the System rack as follows:

1. NetIDB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J100 to Port-1 of the Call Processor computer.

2. NetCSB Connection: Use the 20’ RS-232 cable to connect Shelf 1-J101 to Port-2 of the Call Processor computer.

3. Install a Power Termination Module in the first slot on the left side of each shelf.

4. Install the NetNIM in Shelf-1, Slot-0.

5. Turn "On" both Power Supplies, turn "On" the Call Processor and note that the four LEDs on each PTM card are "On".

   a. Verify that the Call Processor comes up in the Switch mode.

   b. Verify that the Call Processor displays the NetNIM’s clock status, “A Pass B Pass” in the Call Processor’s Device Activity window. (If necessary, press the reset button S1on the NetNIM to activate the clock status.)

PCM Bank Verification

PCM Bank Verification requires 2-Channel Interface Modules (CIMs).

1. On both CIMs place a patch cord from the top jack of J1 to the top jack of J2 (see Figure 10-1).

2. On both CIMs
   Close S1, Sections 3-4
   Open S1, Sections 1-2

3. On both CIMs set switch sections as follows:

Switch	Section
S3	1-2 open; 3-4 closed
S4	1-2 closed; 3-4 open
S5	1-2-3-4 closed.

4. *Set one CIM* for System Test "5"
(S5-Sections 1-3 open; Sections 2-4 closed). Place this module in any slot on Shelf 1.

5. *Set the second CIM* for System Test "6".
(S5-Sections 2-3 open; 1-4 closed). Place this module in any slot on Shelf 8.

6. Loop Primary Tx PCM to the Primary Rx PCM by connecting a cable (023-3039-842) from Shelf 1-J3 to Shelf 1-J4 (see Figure 4-5).

7. The CIMs display an "A" if the PCM bank is good. Press S2 to reset the CIM if "A" is not displayed.

a. A failure on the primary displays a "1" on one or both CIMs.

b. A failure on the secondary displays a "2" on one or both CIMs.
   - Move the CIM on Shelf 8 to Shelf 7.
     Reset both CIMs if "A" is not displayed.
   - Move the CIM on Shelf 7 to Shelf 6.
     Reset both CIMs if "A" is not displayed.
   - Move the CIM on Shelf 6 to Shelf 5.
     Reset both CIMs if "A" is not displayed.
   - Move the CIM on Shelf 5 to Shelf 4.
     Reset both CIMs if "A" is not displayed.
   - Move the CIM on Shelf 4 to Shelf 3.
     Reset both CIMs if "A" is not displayed.
   - Move the CIM on Shelf 3 to Shelf 2.
     Reset both CIMs if "A" is not displayed.

3. After the PCM bank has proven good, force failures on both the primary and secondary as follows:

   Primary
   - Remove cables on Shelf 1, J5 and J6.
   - A "1" on both CIMs indicates a Primary failure.
   - Reconnect the cables.

   Secondary
   - Remove cables on Shelf 1, J23 and J24.
   - A "2" on both CIMs indicates a Secondary failure.
   - Reconnect the cables.
   - Remove the cable from Shelf 1, J3 to J4.

4. Remove both CIMs from rack and patch cords from J1-J2.

VTM PCM Bank Verification

This requires the use of 1-CIM and 1-VTM1.

1. Verify the VTM1 card is in Shelf 1-slot 2.

2. *On the VTM1* connect a Transmission Test Set to TP1 and TP2 (common).

3. *On the VTM1* set S2 to select the 1020 Hz alignment tone. The tone should be heard in the Test Set speaker. Adjust the monitor volume as necessary.

4. *On the CIM*, set all Sections for System Test "1". (S5, Section 1 open; Sections 2,3,4 closed.)

5. Place the CIM in any open slot on Shelf 1.

6. *On the CIM*, connect a Transmission Test Set with the common lead in connector J13.

a. Verify -3 dBm ±0.5 dB at TP3
(adjust R83 if necessary).

b. Verify -12 dBm ±0.5 dB at J12
(adjust R44 if necessary).

3. Move the CIM to an open slot on Shelf 2.
   - Verify -3 dBm ±0.5 dB at TP3.
   - Verify -12 dBm ±0.5 dB at J12

4. Move the module to a open slot on Shelves 3-8 and verify the levels in Step 7.

5. Set the CIM to System Test "0".
(S5 all sections closed.)

6. Remove the CIM form the rack.

4.4.7 FINAL CONFIGURATION VERIFICATION

NOTE: Make sure both power supplies are turned OFF.

1. Disconnect AC Power Cables from AC power source.

2. All PTMs should be installed and configured as follows:

Switch	Sections Closed	Sections Open
S5, S7	3,4,5,6,7	1,2
S6, S8	2,3,6	1,4,5,7,8

3. Select one of the 8 Backplane boards for measuring. Measurements can be made on any of the 64-pin connectors on the Backplane selected.

4. All measurements should be referenced to ground (pins 9, 10, 41 or 42) unless otherwise noted.

5. All test readings should be within 5% of the following specifications:

Pins	Ohms
16/48	37.5
17/49	37.5
18/50	37.5
19/51	75.0
20/52	37.5
21/53	37.5
22/54	100 (measured to +5V DC*)
23/55	37.5
24/56	100 (measured to +5V DC*)

* Pins 11, 12, 43 or 44.

6. On the top Backplane board, the following measurements should be referenced to ground (pins 9, 10, 41 or 42).

Center Pin of	Ohms
J5	37.5
J6	37.5
J23	19.2
J24	19.2

NOTE: The four readings should be ±1 ohm from the test specifications.

7. Test is completed.
Disconnect the cables from the Call Processor.

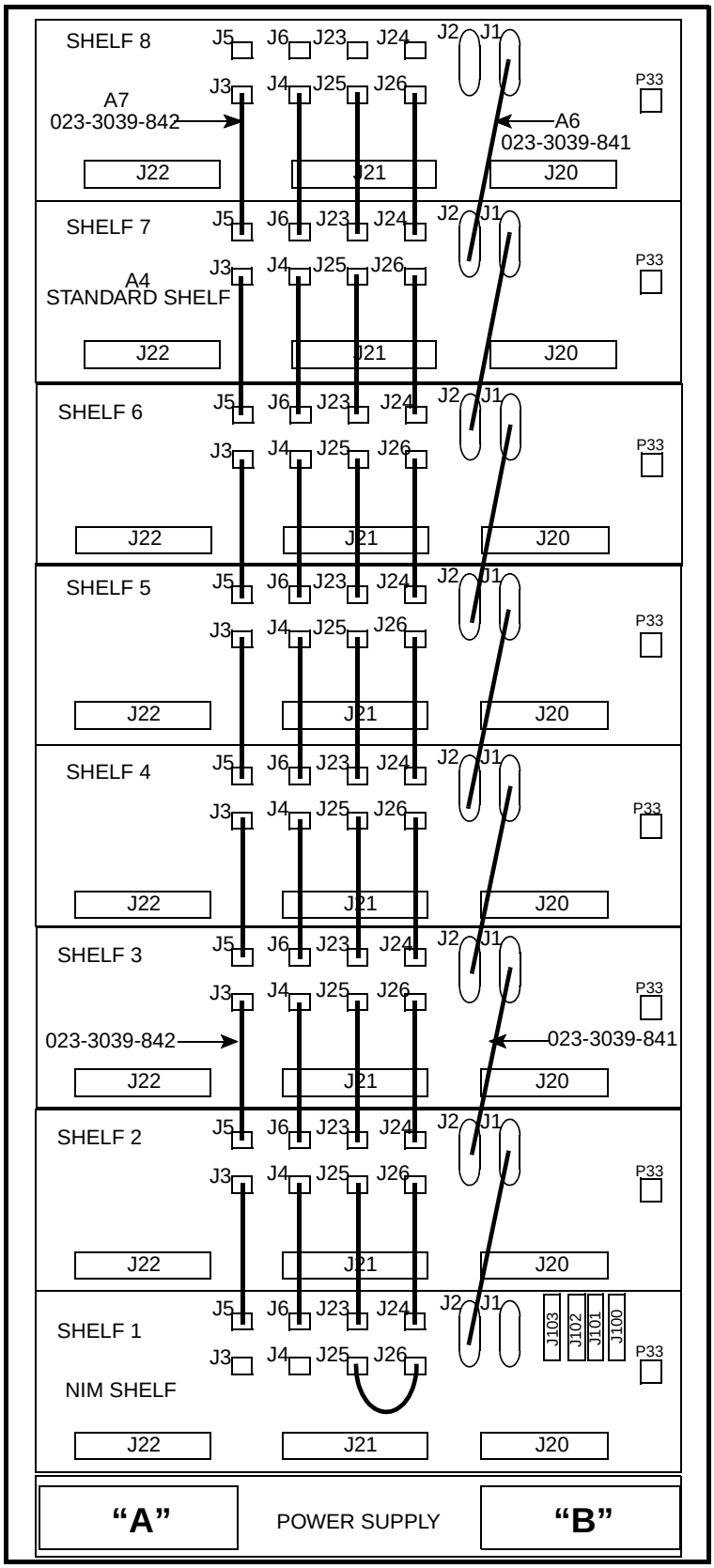


Figure 4-7 EIGHT SHELF 3000 SERIES SWITCH BACKPLANE CABLES

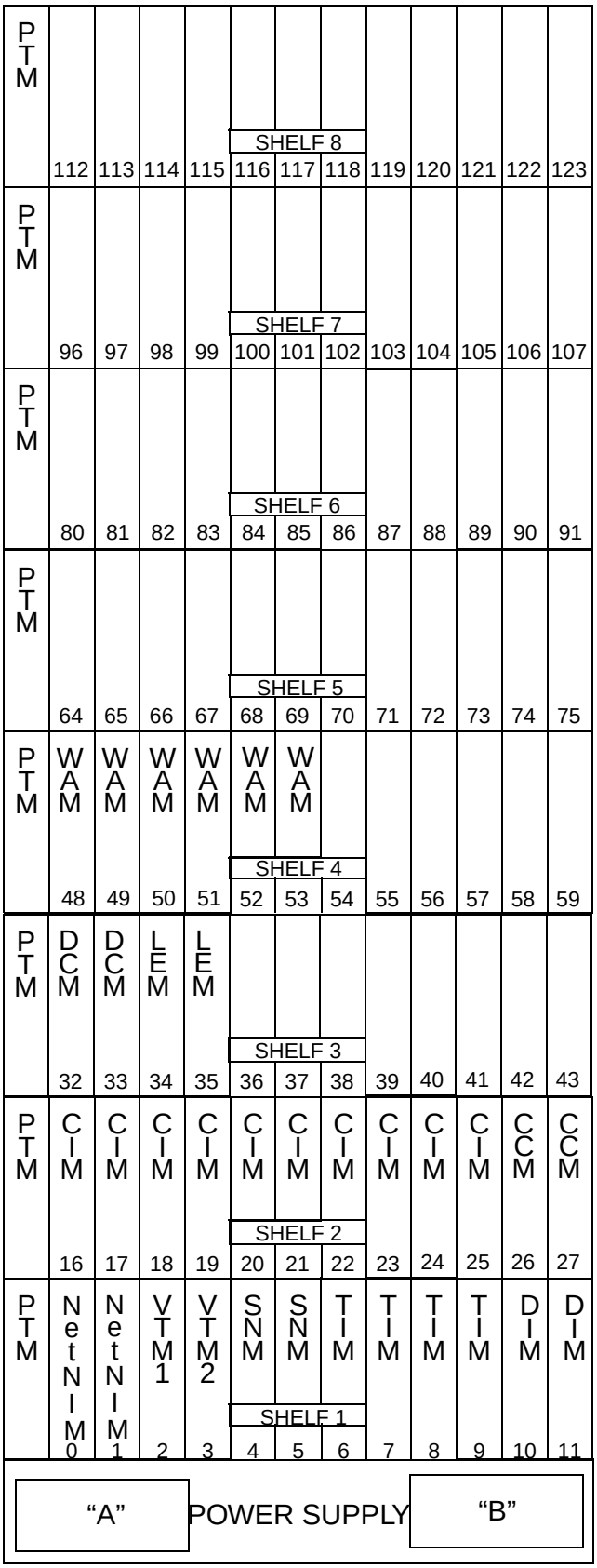


Figure 4-8 8-SHELF 3000 SERIES SWITCH RACK SETUP

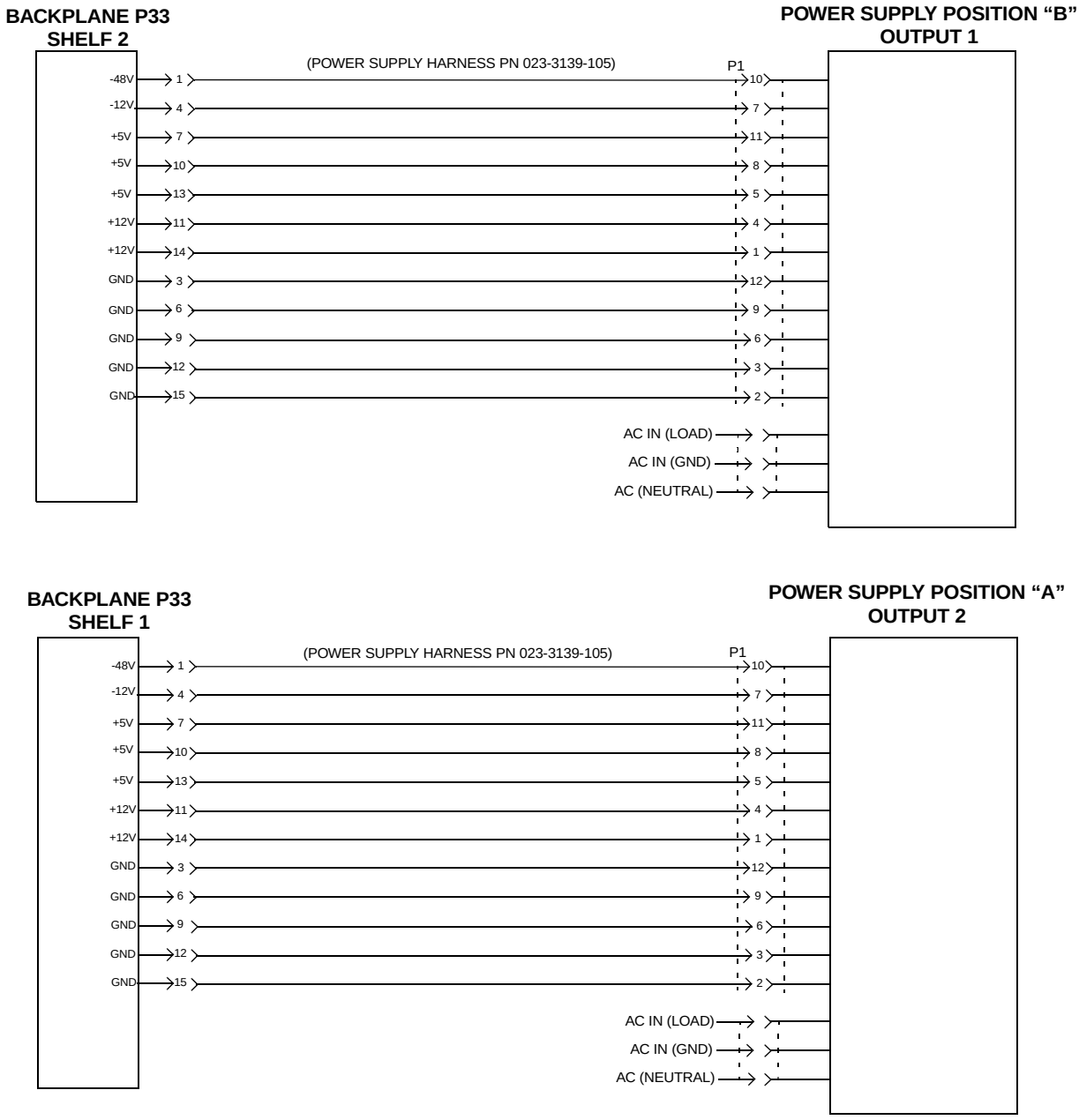


Figure 4-9 2-4 SHELF POWER SUPPLY INTERCONNECT

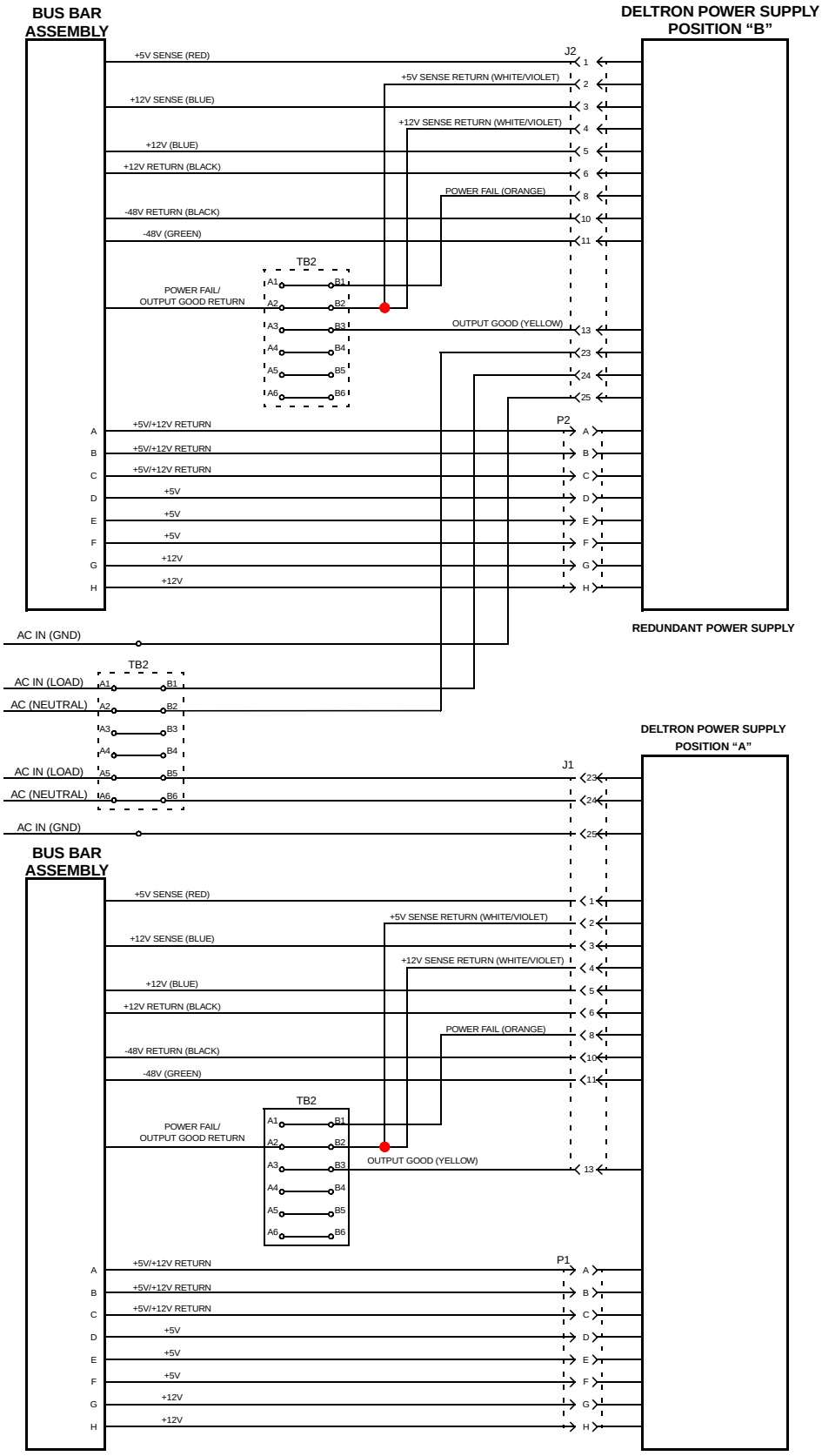


Figure 4-10 6-8 SHELF POWER SUPPLY INTERCONNECT DIAGRAM

SECTION 5 CALL PROCESSOR

5.1 INTRODUCTION

The Call Processor controls the databases for the Switch and provides processing for certain types of calls within the system. The Call Processor consists of the following:

- Large Multi-Net Controller (PN 558-3000-126)
- 10 MHz 4-port RS-232 Assembly (PN 558-3000-122)
- Call Processor Software (PN 023-9998-180).

5.2 DATA BUSES

The Call Processor connects to the system via five different RS-232 ports. The SMB and SSB connect the Call Processor to the Switch via the Network Interface Module (NetNIM). The MAB, RGB and RMB connect the Call Processor to ancillary equipment of the overall system. Refer to Figure 5-1.

1. **Net Intra-Terminal Data Bus (NetIDB)**

   The NetIDB is a 9600 baud full duplex port connected to the Network Interface Module (NetNIM). The NetNIM buffers the Call Processor data to the Intra-Terminal Data Bus (IDB). The Call Processor communicates with the rest of the Switch modules on the IDB via the NetNIM.

2. **Net Channel Status Bus (NetCSB)**

   The NetCSB is a 9600 baud single data path that receives data from the NetNIM to the Call Processor. This data is a “snap shot” of the channel activity from the Channel Status Bus (CSB) within the Switch, collected and buffered by the NETNIM and sent once every two seconds. This information may be used by an external device to determine subscriber air time usage. The NetCSB data protocol and format are available upon request.

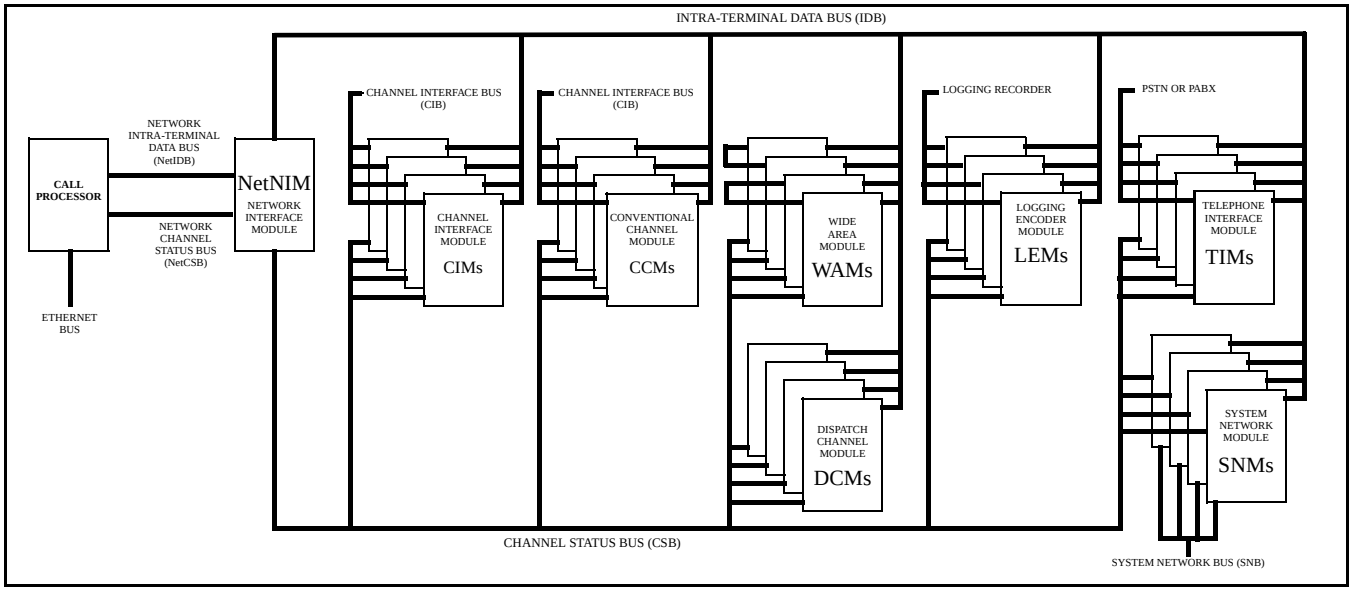


Figure 5-1 DATA BUSES

5.3 CALL PROCESSOR CONTROL

The Call Processor controls several different databases and secondary functions of the Switch. The following are some of the major functions of the Call Processor.

5.3.1 SYSTEM CONFIGURATION

The system configuration provides for initialization of modules and database management. When a module sends an initialization request to the Call Processor, the Call Processor searches the configuration database and sends initialization information to the module. If the module number is not found, the Call Processor creates an alarm and places the module in standby mode.

The specific parameters for each module are contained in the database. Both configuration's database and Switch-to-site setup is viewed or modified and the channel configuration's loading time is set. The system analyzer parameters may be viewed and modified. The system loading may be viewed. The total configuration database is stored and retrieved from hard disk or floppy disk.

5.3.2 MANUAL DEVICE CONTROL

The manual device control allows the operator to do the following:

1. Restart single or multiple modules
2. Enable/disable a module from operation
3. Read/write to memory of modules or devices
4. Set date/time.
5. Turn on/off the alarm records storage, activity log, and screen saver functions
6. Change password.
7. Change the system title of the SMM.
8. Control the receiver voter functions.
9. Control the system analyzer operator by site.

5.3.3 SUBSCRIBER MANAGEMENT

The Subscriber Management allows an operator to view, set or modify the Home/Group IDs and the Unique IDs permissions. Unique IDs may be controlled for suspend audio, and selective unit disable (kill).

The Dynamic Reassignment of Unique IDs can be controlled from the Call Processor. A Unique ID may be moved to a new System and Group or it may have the programmable group of a system set to a new group.

This function allows the following:

1. A Unique ID to be interrogated.
2. The current ID being used on each channel to be displayed by the operator.
3. Access for each user for Group and Unique IDs can be set or viewed for RMF control.
4. Passwords for each user may be assigned for RMF control.

The file management for the above databases is done by storing and retrieving the files from the hard disk or floppy disk.

5.3.4 ACTIVITY LOG UTILITIES

The system operator can use the Call Processor keyboard to enter information messages. The Call Processor monitor activity window displays alarms and information for the current day's log and history files. The activity log contains a time stamp of when the activity occurred.

5.3.5 CALL COMPLETION

The call completion function handles database management of trunk assignments and telephone number assignments. The trunk assignments may be viewed, set, stored or retrieved on both hard disk and floppy disk. The telephone numbers are viewed and assigned Unique IDs and the telephone assignment database is stored and retrieved on the hard disk and floppy disk.

5.3.6 KEYBOARD LOCK

The system operator has the ability to lock the keyboard by password control to prevent the unauthorized use of the Call Processor. The password is a single level of control.

5.3.7 LOG OUT/LOG IN

This function allows the operator to log out of Call Processor thereby locking the keyboard from unauthorized usage. Once the Call Processor has been logged out, the function becomes Log In. The log in function will ask for a password. If the password is not correct, access is denied.

5.4 ALARM CONTROL

The alarm control is where errors are time stamped and passed to the activity log function and the message accounting output function.

5.5 SYSTEM ANALYZER

The Call Processor has the ability to perform an analysis on the system. This is a complete handshake (interrogation) of a test mobile in the RF coverage of sites. This verifies the correct operation of the system to and from the mobile. The analysis includes all links including the antenna systems and RF coverage. The system analyzer has the ability to automatically disable channels from the system that do not pass the analysis.

5.6 CALL PROCESSING

The Call Processor processes Unique ID calls, telephone calls and group site calls *(see Call Sequence Appendix B)*. Normal dispatch call processing is handled independently in the associated modules.

The Call Processor determines if an originated Unique ID call is to be automatically routed or not and routes the call to the appropriate facility, i.e. DIM or SNM. The destination Unique ID call is processed by the Call Processor to determine routing to a DIM or CIM. Both origination and destination calls are accounted for and a message accounting record is generated.

The dialed digits of an incoming telephone call determine the Unique ID requested and the Call Processor routes the call to where the Unique ID is registered. The Call Processor determines if the Unique ID on an outgoing call has the proper permission for the digits dialed, selects the proper trunk, and creates a message accounting message.

The group site call is routed to the site selected on origination and creates a message accounting record.

The Call Processor uses the information from the SSB to validate the use of the system for audio on Home repeater channel, Group ID sets and Unique IDs. If an unauthorized user is detected, the Call Processor intervenes and disconnects the audio being transmitted from the modules or mobiles.

This page intentionally left blank.

SECTION 6 NETWORK INTERFACE MODULE (NetNIM)

6.1 DESCRIPTION

The NetNIM interfaces the Call Processor to the internal communication of the Switch. The NetNIM passes data communication via a 19200 baud full duplex channel on the Intra-Terminal Data Bus (IDB) to the Network Intra-terminal Data Bus (NetIDB) at 19200 baud. The NetNIM also passes data between the Channel Status Bus (CSB) to the Network Channel Status Bus (NetCSB).

The Master Clock and Master Sync for the PCM busses are redundant in the NetNIM. A detection circuit monitors the two different sets and if Master Clock-A is off frequency, Master Clock-B is activated. If both -A and -B are off frequency, an alarm is sent to the Call Processor and the NetNIM removes both sets from distribution in the Switch.

The Switch is allowed a Master and Slave NetNIM, enabled or disabled from operation on the data communication path. The master tells the slave when both of its clocks are off frequency and the slave clock is distributed, if the slave clocks are on frequency.

6.2 OPERATION

The NetNIM may be redundant using a master and slave module. The master is placed in a card slot with the least significant bit equal to zero. The slave is placed in a card slot with the least significant bit equal to one. The NetNIM Master/Slave LED is ON for master and OFF for slave.

The card slot(s) used for the NetNIM has the backplane wired for this operation. Refer to Section 23 for further details.

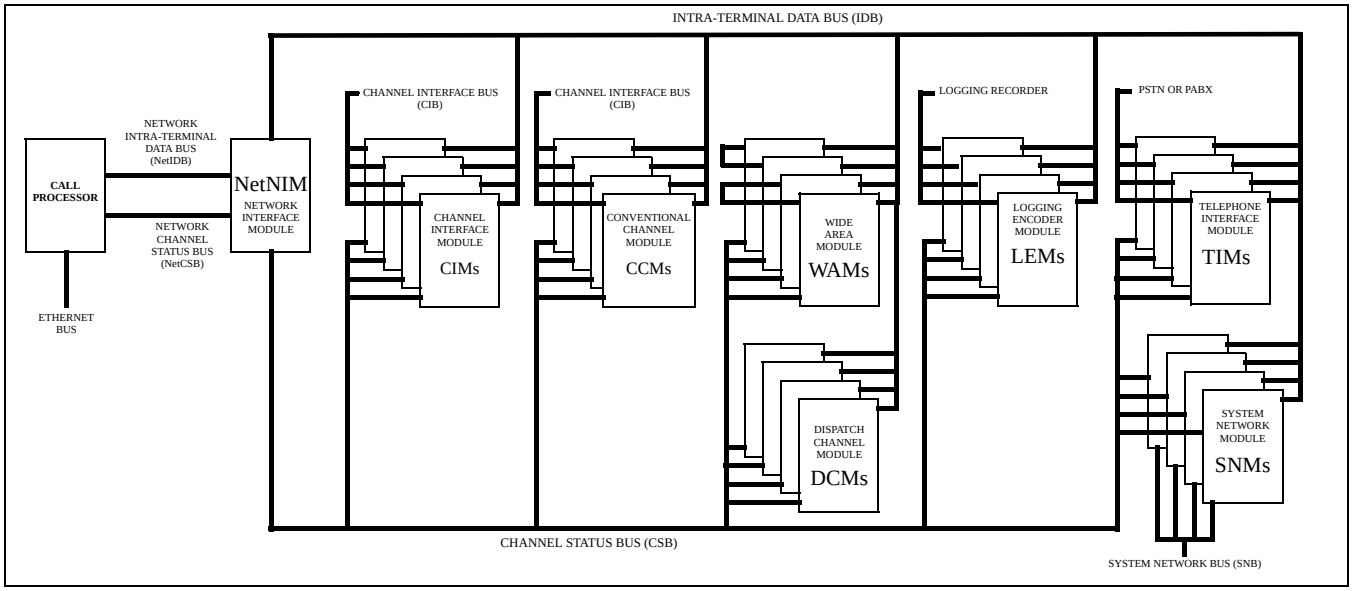


Figure 6-1 DATA BUS BLOCK DIAGRAM

6.2.1 LEDS

1. Clock A and B LED

Clock A/B LED is on for clock A and off for clock B.

2. Companion Clock LED

The companion clock LED is on if the companion card indicates a malfunction or if the companion card is not installed. Otherwise, the clock(s) are functioning and the LED is off.

3. Comm to SMM LED

The Comm to SMM LED is on if the NIM is the selected unit to communicate to the SMM. Otherwise, the LED is off.

4. Alarm LED

The Alarm LED is on if there is a NIM failure. This is presently done on power-up if there is a RAM or ROM malfunction.

6.3 SETUP PROCEDURE

6.3.1 JUMPERS

J11 and J12 select the Tx/Rx direction of the SSB lines. J13 and J14 select the Tx/Rx direction of the SMB lines. (See Figure 6-3.)

6.3.2 SWITCHES

S1 - Reset

Normally open, press to reset. Momentary switch used to reset the module.

6.4 ALIGNMENT SPECIFICATIONS

The NetNIM alignment ensures the correct PCM Clock and Sync frequencies and sets the frequency detectors.

1. Measure the frequency of clock "A" at TP31 with a 10 MHz counter.
2. Adjust C62 for 4.096 MHz ±200 Hz at TP31.
3. Measure the frequency of U30, pin 1 for 4 kHz ±0.25 Hz.
4. Measure the frequency of clock "B" at J32 with a 10 MHz counter.
5. Adjust C65 for 4.096 MHz ±200 Hz at TP32.
6. Measure the frequency of U29, pin 1 for 4 kHz ±0.25 Hz.

Table 6-1 NIM JUMPERS

Jumpers	Pins	Bus
J11 J12 J13 J14	1 to 2 1 to 2 1 to 2 1 to 2	NetCSB Rx NetCSB Tx NetIDB Rx NetIDB Tx
NetCSB	Pins	Baud Rate
J15	1 to 2 3 to 4 5 to 6 7 to 8 9 to 10	19200 9600 (normal) 4800 2400 1200
NetIDB	Pins	Baud Rate
J16	1 to 2 3 to 4 5 to 6 7 to 8 9 to 10	19200 9600 (normal) 4800 2400 1200
PROM Addressing		Addressing
J24-pin 1 to J25-pin 1 J24-pin 2 to J25-pin 2		27256 (normal)
J24-pin 1 to J25-pin 1 J24-pin 3 to J25-pin 3		27128
J24-pin 1 only J24-pin 3 to J25-pin 3		2764
Watch-Dog Timer Operation		
J26 - Not used, jumper is placed on J26-pin 1 only for normal operation.		
DCB/CSB Data Bus Select		Data Bus
J33	pin 1 to pin 2	Switch CSB (normal)
	pin 2 to pin 3	ACS

6.4.1 DETECTOR SETTING

For this alignment use a DC voltmeter with a 0.001V resolution.

1. Measure the voltage between TP34 and TP36.
2. Adjust R93 for 0V ±0.005V.
3. Check U31, pins 1 and 2 for < 0.8V.
4. Measure the voltage between TP33 and TP35.
5. Adjust R75 for 0V ±0.005V.
6. Check U31, pin 13 and 14 for < 0.8V.
7. Check U37, pin 6 for, 0.8V.

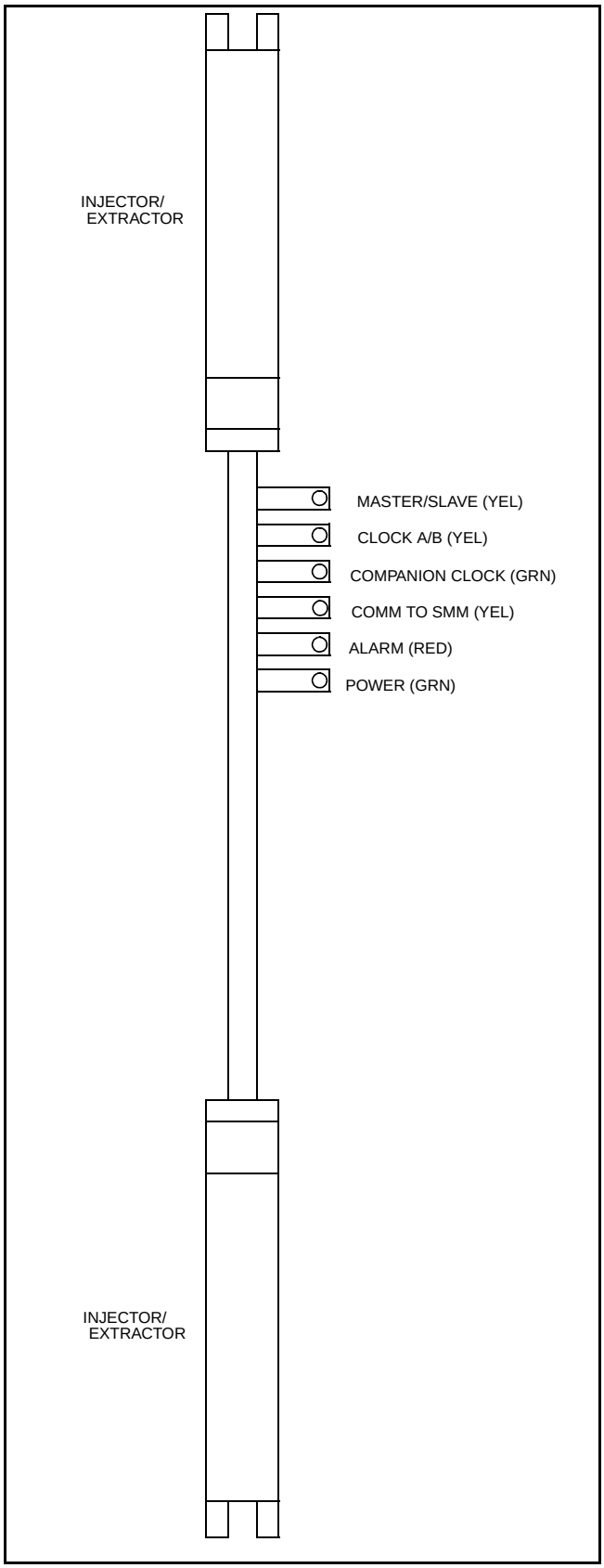


Figure 6-2 NetNIM CARD EDGE LAYOUT

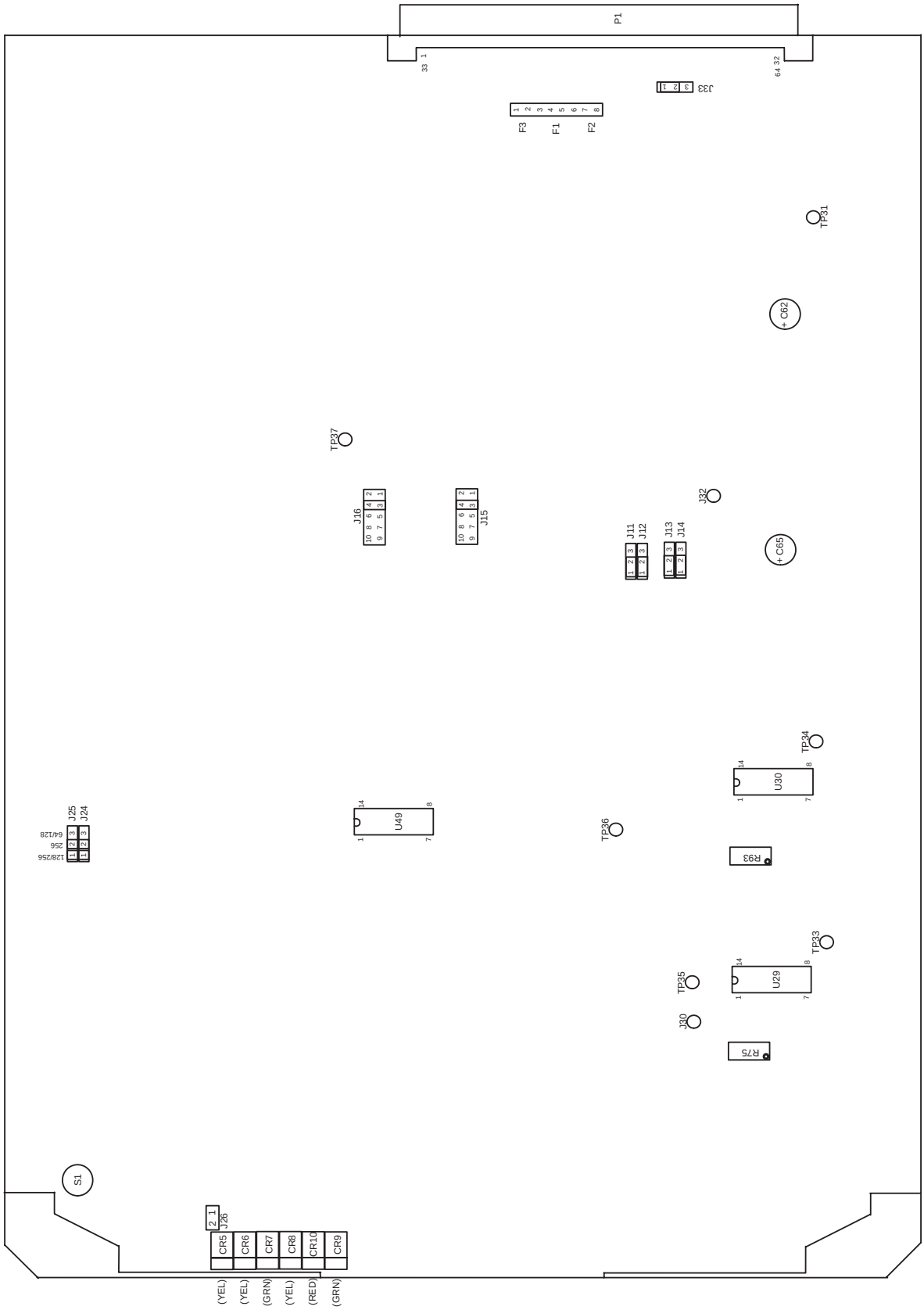


Figure 6-3 NetNIM ALIGNMENT POINTS DIAGRAM

SECTION 7 BASIC BOARD MODULE (BBM)

7.1 DESCRIPTION

The Basic Board Module (BBM) is the mother board of the following modules:

- Dispatch Interface Module (DIM)
- Intelligent Dispatch Module (IDM)
- Dispatch Channel Module (DCM)
- Channel Interface Module (CIM)
- Telephone Interface Module (TIM)
- System Network Module (SNM)
- Conventional Channel Module (CCM)
- Logging Encoder Module (LEM)
- Voter Diagnostic Module (VDM)
- Multi-Net Console Module (MCM)
- Conventional Patch Module (CPM)
- Wide Area Module (WAM)

These modules are made up of the BBM plus the appropriate software and personality cards as required.

The BBM uses four wire audio to connect to the external equipment. There is an additional connection for secondary data transmission.

7.1.1 MAIN AUDIO

The main external audio connection is via RXA±, P1, pins 31 and 32, and TXA±, P1, pins 63 and 64. These connections go to P33. This allows the personality cards to intercept the lines. When a 2-Wire connection is required on a module, it enters the card via the RXA± connection. The personality card then intercepts the signal on P33, pins 2 and 4. The receive and transmit buffers are connected to the personality card via P33 also. Refer to the Basic Board Module block diagram, Figure 7-1.

7.1.2 SECONDARY COMMUNICATION

There is a secondary communication connection to the BBM. This is used to pass data information to and from an external device, i.e. the Multi-Net Logic Module (MLM), another SNM, etc. These connections are the RXS±, P1, pins 27 and 28, and TXS±, P1, pins 59 and 60. There are two forms of communication on these lines, digital and audio frequency shift keyed data. The form of communication is determined by the switch setting of S3 and S4.

7.1.3 INTERNAL COMMUNICATION

There are several switch selections for the proper internal routing and use of the audio. This occurs via switch S1 and J27. There are several internal communication buses that are selected for operation of the microprocessor. These include both data and audio buses.

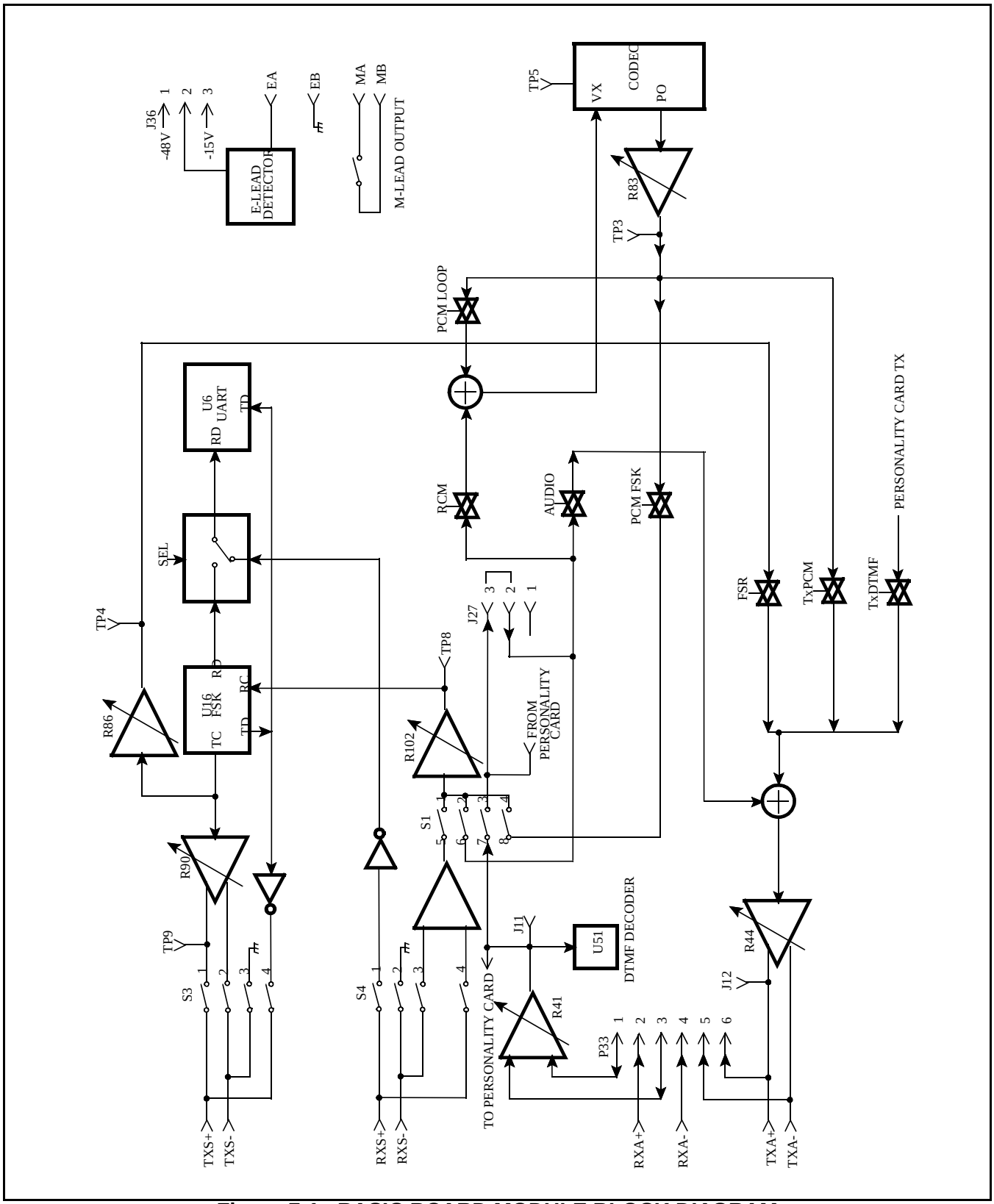


Figure 7-1 BASIC BOARD MODULE BLOCK DIAGRAM

7.2 BBM SETUP PROCEDURE

Refer to the Tables in this section for switch settings, jumper placements and the backplane wire harness description. Also refer to Section 23 for more information on the backplane.

7.2.1 SWITCH SETTINGS

Refer to the Basic Board Module alignment points diagram Figure 7-2 for the location of these switches.

7.2.2 JUMPER PLACEMENT

Refer to the Basic Board Module alignment points diagram Figure 7-2 for the location of these jumpers.

7.2.3 BBM BACKPLANE EXTERNAL CONNECTIONS

See the Backplane Section 23 for pin-outs on the shelf backplane and wire harness pin-outs.

Table 7-1 BASIC BOARD SWITCH SETTINGS

Sw	Sec	Description
S1	1 2 3 4	AFSK Data Receive Secondary Line AFSK Data Receive Main Audio Input Voice from main board AFSK Data Receive from PCM
S2		Resets the microprocessor
S3	1 2 3 4	AFSK Secondary Transmit Data + AFSK Secondary Transmit Data - Digital Secondary Transmit Data ground Digital Secondary Transmit Data signal
S4	1 2 3 4	Digital Secondary Receive Data signal Digital Secondary Receive Data ground AFSK Secondary Receive Data + AFSK Secondary Receive Data -
S5	1 2 3 4	Bit 0 - Alignment Test Switch Bit 1 Bit 2 Bit 3

Table 7-2 BASIC BOARD JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2 2 to 3*	Not Used Normal operation
J27	1 to 2 2 to 3*	Not Used No ALC
P33	1 to 2* 3 to 4* 5 6	No personality card attached No personality card attached open open
J36	1 only* 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Normal setting.		

Table 7-3 BACKPLANE PIN-OUTS

Backplane P34 to P45	Description	Wire Harness P-Odd J1,3,5,7		
pin 25	Test Tx Data	pin 1		
pin 26	Test Rx Data	pin 2		
pin 27	Sec Rx +	pin 3	RxS+	pin 1
pin 28	Sec Rx -	pin 4	RxS-	pin 2
pin 29	EA lead	pin 5	EA	pin 3
pin 30	EB lead	pin 6	EB	pin 4
pin 31	main Rx Audio, Tip +	pin 7	RxA+	pin 5
pin 32	Main Rx Audio, Ring _	pin 8	RxA-	pin 6
		P-Even		**J2,4,6,8**
pin 57	Alarm	pin 1		
pin 58	Alarm	pin 2		
pin 59	Sec Tx +	pin 3	TxS+	pin 1
pin 60	Sec Tx -	pin 4	TxS-	pin 2
pin 61	MA lead	pin 5	MA	pin 3
pin 62	MB lead	pin 6	MB	pin 4
pin 63	Main Tx Audio +	pin 7	TxA+	pin 5
pin 64	Main Tx Audio -	pin 8	TxA-	pin 6

7.3 BBM ALIGNMENT PROCEDURES

7.3.1 INTRODUCTION

The module is designed to operate at a maximum input level and maintain that level without added distortion or noise levels significantly different from the maximum input level. The overall distortion should be less than 5% with noise less than -45 dB, C-message weighted. Adjustments at the maximum level are difficult due to possible higher distortion and clipping of the signal, therefore, an average level is used for alignment. A voice application typically uses an average level that is -12 dB from the maximum level. When the module(s) are pre-aligned with the -12 dB average level, the only adjustment necessary is to set the input and output levels to the -12 dB level.

The module contains operational amplifier stages with gain that require the absolute alignment level to be lowered by the gain of the op amp stage. The module op amp stages have a +9 dBm output swing. Since the alignment level is -12 dB from maximum, the absolute average alignment level would be -3 dBm for a unity gain op amp stage.

The module contains a PCM CODEC chip that converts the analog audio to digital and back to analog. The maximum input of the codec is +6 dBm absolute level since there is a gain of 3 dB in the circuitry and the output stage can handle +9 dBm absolute level. The +6 dBm input level requires the average alignment level to be lower than a -6 dBm absolute level.

7.3.2 ALIGNMENT

The basic module is pre-aligned with a tone of 1004 Hz at -12 dBm with a 600 ohm driving impedance. The -12 dBm level is verified by measuring the level across the interface with a high impedance balanced AC voltmeter. The main audio levels of the module relative to the input are adjusted to provide pre-alignment.

1. Set the module for pre-alignment. Refer to the Alignment Points Diagram Figure 7-2.

   a. Inject 1004 Hz at -12 dBm at EQU of Rx input J1.

   b. Jumper J27, pin 2 to pin 3.

   c. No personality card attached with P33, pin 1 jumpered to pin 2 and pin 3 jumpered to pin 4.

   d. Close S1, section 3.

   e. Open S1, sections 1, 2 and 4.

   f. Set S5 for test 1, open section 1; close sections 2, 3, and 4.

   g. Reset the module, press S2 and release.

2. Main Rx Audio input level from J1.

   a. Setup for alignment as in Step 1.

   b. Adjust R41 to -6 dBm ±0.5 dB at J11.

   c. Verify the level at TP5 of the CODEC to be -6 dBm ±1 dB.

3. Main Rx to FSK input from J1.

   a. Setup for alignment as in Step 1.

   b. Close S1, section 2.

   c. Adjust R102 for -12 dBm ±1 dB at TP8.

   d. Open S1, section 2.

4. Main Tx Audio output level from J1.

   a. Setup for alignment as in Step 1.

   b. Adjust R83 for a -6 dBm ±0.5 dB at TP3.

   c. Adjust R44 for a -12 dBm ±0.5 dB at J12.

5. FSK Output

   a. Set S5 for test 8. Close sections 1, 2 and 3, Open section 4.

   b. Reset the module, Press S2 and release.

c. Adjust R90 for -12 dBm ±0.5 dB at TP9.

d. Adjust R86 for -12 dBm ±0.5 dB at TP4.

e. Verify the level at J12 to be -21 dBm ±1 dB.

6. Normal Operation

a. Set S5 to 0 (normal operation). Close section 1, 2, 3 and 4.

b. Reset the module, Press S2 and release.

c. Remove the input alignment tone from J1.

7.4 TEST TASKS

The following are the eight available tests with the Test Switch S5 and the functions the module performs. These tests can be used for additional verification of a module and the system.

7.4.1 SYSTEM SWITCH EQUALS "1"

1. Connects the System Alignment Tone on the VTM Bus to the Transmit Audio.
2. Close the telephone line relays to connect to the telephone line.

7.4.2 SYSTEM SWITCH EQUALS "2"

1. Turns on the TXDTMF gate.
2. Programs the tone remote personality card for 2175 Hz at maximum level.
3. Turns on the tone to the main transmit line.

7.4.3 SYSTEM SWITCH EQUALS "3"

1. Turns on the TXDTMF gate.
2. Programs the tone remote personality card for DTMF.
3. Sends the tone out the main transmit.

7.4.4 SYSTEM SWITCH EQUALS "4"

1. Sends an FSK message out the main transmit.
2. Receives the message on the main receive.
3. Sends a digital message out the secondary transmit.
4. Receives the message on the secondary receive.
5. Closes the M-lead and receives the E-lead input.
6. If display shows:

a. "A" - all three tests passed.

b. "1" - main test failed.

c. "2" - secondary test failed.

d. "3" - M-lead/E-lead test failed.

7.4.5 SYSTEM SWITCH EQUALS "5"

1. Sends an FSK message on both the main and secondary transmit PCMs in Slot 31.
2. Receives a message on both the main and secondary receive PCMs in Slot 0.
3. If display shows:

a. "A" - both receive messages passed.

b. "1" - main receive message failed.

c. "2" - secondary receive message failed.

7.4.6 SYSTEM SWITCH EQUALS "6"

1. Sends an FSK message on both the main and secondary transmit PCMs in Slot 0.
2. Receives a message on both the main and secondary receive PCMs in Slot 31.

3. If display shows:

   a. "A" - both receive messages passed.

   b. "1" - main receive message failed.

   c. "2" - secondary receive message failed.

7.4.7 SYSTEM SWITCH EQUALS "7"

1. Closes the relays on the telephone line personality card to connect the telephone line and the Silent Slot of the VTM Bus to the main transmit audio.

7.4.8 SYSTEM SWITCH EQUALS "8"

1. Turns on the FSK transmit for the 1200 Hz tone.

2. Turns on the FSR gate to the main transmit audio.

7.4.9 SYSTEM SWITCH EQUALS "9"

1. This allows the TIM-DID to answer an incoming call and to provide a System Alignment Tone to the telephone line. This allows the DID to have the hybrid adjust circuit tuned.

7.5 TROUBLESHOOTING

This section provides some basic hardware troubleshooting procedures. These procedures follow the Test Tasks (See Section 7.4).

7.5.1 TEST "1"

System Alignment Tone Test.

1. The Test Tone of 1004 Hz should be -3 dBm ±1 dB at U19, pin 2 (CODEC IC).

2. The tone should pass through op amp U32A. Adjust R83 for a level of -6 dBm ±0.5 dB at TP3.

3. The tone should pass through transmission gate U31B with less than 0.25 dB of loss. This gate should have a high on U31B, pin 5 (control pin), from U46A, pin 1.

   The transmission gates U30A, U30B, U31D, U31C, U57C and U31A should be off (< 1V on the control pins). U46, pins 5, 3, 9, 11 and 13 should be low (< 1V). U6, pin 15 should be high, > 4.5V.

4. The tone should pass through the op amp 600 ohm line drivers, U28A and U28B. Adjust R44 for a level of -12 dBm ±1 dB at J12. The level should be -12 dBm ±1 dB across the Tx line.

TIM With DID Personality Card (-660)

1. The Test Tone of 1004 Hz should be -3 dBm ±1 dB at U19, pin 2 (CODEC IC).

2. The tone should pass through op amp U32A. Adjust R83 for a level of -6 dBm ±0.5 dB at TP3.

3. The tone should pass through transmission gate U31B with less than 0.25 dB of loss. This gate should have a high on U31B, pin 5 (control pin), from U46A, pin 1.

4. The tone should pass through the op amp 600 ohm line drivers, U28A and U28B. Adjust R44 for a level of -8 dBm ±1 dB at J12.

5. The tone should pass through P33, pins 5 and 6 to the personality card to R263 and transformer T201, pins 10 and 9, via the jumper. Relay K204 should be active
   (< 1V on pin 8), U208, pin 16 should be high (> 4.5V).

6. The audio should pass through to the line with a level of -12 dBm ±2 dB across a series 600 ohm and 2.2 microfarad capacitor.

TIM With 2WY Personality Card (-670)

1. The Test Tone of 1004 Hz should be -3 dBm ±1 dB at U19, pin 2 (CODEC IC).

2. The tone should pass through op amp U32A. Adjust R83 for a level of -6 dBm ±0.5 dB at TP3.

3. The tone should pass through transmission gate U31B with less than 0.25 dB of loss. This gate should have a high on U31B, pin 5 (control pin), from U46A, pin 1.

4. The tone should pass through the op amp 600 ohm line drivers, U28A and U28B. Adjust R44 for a level of -8 dBm ±1 dB at J12.

5. The tone should pass P33, pins 5 and 6 to the personality card to transformer T201, pins 9 and 10 via the jumper.

- Relay K204 should be active (< 1V on pin 8)
- Latch U208, pin 16 should be high (> 4.5V)
- Relay K203 should be active (< 1V on pin 2)
- Latch U208, pin 17 should be high (> 4.5V)
- Relay K202 should be active (< 1V on pin 2)
- Latch U208, pin 18 should be high (> 4.5V)
- Relay K201, K205 and K206 should be inactive (> 11V on pin 2 and 8 of each)
- Latch U208, pins 14/15/19 should be low (< 1V).

6. The audio should pass through to the line with a level of -12 dBm ±2 dB across a series 600 ohm and 2.2 microfarad capacitor.

7.5.2 TEST "2"

This sends 2175 Hz tone from the Tone Remote Personality Card (-420) to the line.

1. The 2175 Hz tone is generated on the -420 board by U209, U212 and U213. The tone is passed through buffer op amp U204B and the major level control U214A and U214B.

2. The 2175 Hz tone passes through adjustment op amp U204A.
- Adjust R267 for a level of +8 dBm ±0.5 dB at EP226.
- This passes through summing op amp U201C and to the main board via STXA P202, pin 2.

3. The 2175 Hz tone pass through transmission gate U31A.
- This gate should have a high on the control pin (U31A, pin 13), from U46, pin 13.
- The transmission gates U30A, U30B, U31D, U31C, U57A and U31B should be off (< 1V on the control lines).
- U46, pins 1, 3, 5, 9, 11 and 13 should be low (< 1V). U6, pin 15 should be high (> 4.5V).

4. The tone should pass through the op amp 600 ohm line drivers, U28A and U28B.
- Adjust R44 for a level of -1 dBm ±1 dB at J12.
- The level should be -1 dBm ±1 dB across the Tx line.

7.5.3 TEST "3"

This sends a DTMF digit "5" tone from the Tone Remote Personality Card (-420) to the line.

1. The DTMF digit is generated on the -420 board by U218.
- The digit passes through adjustment op amp U201A.
- Adjust R216 for a level of -3 dBm ±0.5 dB at EP223.
- This passes through summing op amp U201C and to the main board via STXA P202, pin 2.

2. The digit passes through transmission gate U31A.
- This gate control pin (U31A, pin 13) should be high, from U46, pin 13.
- The tone should pass through the op amp 600 ohm lines drivers, U28A and U28B.
- Adjust R44 for a level of -12 dBm ±1 dB at J12.
- The level should be -12 dBm, ±1 dB across the Tx line.

7.5.4 TEST "4"

This tests the card for sending and receiving data messages via FSK on the Main Audio and via digital on the Secondary Data lines. The M-lead and E-lead circuitry is tested.

1. Sends an FSK message out the main transmit.

- The FSK is generated by U16, then passes through level op amp U32B.
- Adjust R86 for a level of -12 dBm ±0.5 dB at TP4.
- The FSK then passes through transmission gate U31C and balanced line driver op amps U28A and U28B.
- Adjust R44 for a level of -21 dBm ±1 dB at J12.
- The level should be -21 dBm ±1 dB across the Tx line.

2. Receives the message on the main receive.

- The main transmit is looped back to the main receive.
- The FSK enters the balanced to unbalanced receiver U28C and U28D.
- Adjust R41 for a level of -21 dBm ±1 dB at J11. The FSK goes to switch S1, close section 3.
- The FSK goes through J27 with pins 2/3 jumpered together.
- The FSK goes to switch S1, close section 2, open sections 1 and 4.
- The FSK passes through level op amp U34B.
- Adjust R102 for a level of -12 dBm ±1 dB at TP8.
- The FSK is then passed to U16 to be decoded.
- The serial data is then passed through transmission gate U33C to the DUART U6 to be sent to the microprocessor.

3. Sends a digital message out the secondary transmit.

- The digital data is sent by the DUART U6 and sent out of the RS-232 driver U35E.
- Close sections 3 and 4 on S3.

4. Receives the message on the secondary receive.

- The secondary transmit is connected to the secondary receive.
- Close sections 1 and 2 of S4.
- The data is received by the RS-232 receiver U35D and is passed to the DUART U6 through the transmission gate U33D.

5. Closes the M-lead and receives the E-lead.

- The relay K1 is activated to close the M-lead.
- The M-lead is connected to the E-lead.
- J36 is jumper to pin 1 and 2 or pin 2 and 3.
- The E-lead is detected by opto isolator U29.
- This indication is passed to the microprocessor.

7.5.5 TEST "5"

This test is used with Test "6" to verify the correct operation of the main and secondary PCMs. Use Test "1" and Test "8" to setup the cards.

1. Sends an FSK message on both the Main and Secondary Transmit PCMs in Slot 31.

- An FSK message is generated and is sent through the leveling op amp U32B.
- The FSK message is passed through transmission gate U31C.
- This is then sent out the balanced op amp drivers U28A and U28B.
- The transmit is looped to the receive of the same card.
- The FSK message is received by the balanced line receiver op amp U28C and U28D.
- The message is routed to J27, pin 2 and pin 3 connected together.
- The message then passes through transmission gate U30B to the summing op amp U32C.
- The message is then sent to the CODEC ID U19.
- The transmit time slot is determined by U26, U22, U23, U36A, U36B, U20 and U21.
- The PCM is then routed to the main PCM via U25 through the selection by microprocessor U7, pin 5 and Pin 48.
- Once the message is sent via the main PCM it is then routed to the secondary PCM.

2. Receives a message on both the main and secondary receive PCMs in Slot 0.

- The PCM is received by U59 and U26.
- The appropriate PCM is selected by selecting transmission gate U27A for the Main PCM and U27D for the Secondary PCM.
- The PCM is then passed to the CODEC IC U19. The receive time slot is determined by U26, U55, U56, U3A, U3B, and U52.
- The output of the CODEC IC passes through leveling op amp U32A.
- The message then passes through transmission gate U57C to switch S1, section 4.
- The message then passes through leveling op amp U34B to the FSK IC U16.
- The message is converted to digital and is passed through transmission gate U33C to the DUART U6 to be decoded by the microprocessor.

7.5.6 TEST "6"

This test is used in conjunction with Test "5" to verify the correct operation of the main and secondary PCMs. Use Test "1" and Test "8" to setup the cards.

This test is the same as Test "5" but transmits in Slot 0 and receives in Slot 31.

7.5.7 TEST "7"

Closes the relays on the telephone line personality card. This connects the telephone line and the Silent Slot of the VTM Bus to the main transmit audio.

This test is conducted the same as Test "1" except the System Alignment Tone is replaced with the Silent Slot of the VTM PCM.

7.5.8 TEST "8"

Turns on the FSK and transmits the 1200 Hz tone.

1. The FSK is generated by U16, passes through level op amp U32B.
- Adjust R86 for a level of -12 dBm ±0.5 dB at TP4.

2. The FSK then passes through transmission gate U31C with less than 0.25 dB of loss. The control line (U31C, pin 6) should be high (> 8V).

3. The signal then passes to the balanced line driver op amps U28A and U28B.
- Adjust R44 for a level of -21 dBm ±1 dB at J12.
- The level should be -21 dBm ±1 dB across the Tx line.

7.5.9 TEST "9"

This allows the TIM-DID to answer an incoming call and provide System Alignment Tone to the telephone line. This allows the DID to have the hybrid adjust circuit tuned.

This test is the same as Test "1". The exception here is that the DID waits to answer the incoming call and then sends the System Alignment Tone to the telephone line.

7.6 DS1 DISPLAY DEFINITIONS

The following tables define the tasks performed when displayed on DS1.

Table 7-4 DIM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
3	Transmit
4	Receive
5	All Call
6	Connect PTT
7	Trunk Verification
8	Interrogate
9	Trunk Conversation
A	Facility Acquisition
A	Await Trunk
B	Trunk Destination Conversation
C	Ring Channel
D	Channel Conversation
E	Console Initialization
F	Standby

Table 7-5 CCM CARD DISPLAY TASKS

DS1	**TASK**
0	Initialization
1	Await Enable
2	Idle
2*	IDB Bus Access Error
3	Transmit
3*	CSB Bus Access Error
4	Receive
5	Duplex
8	Suspend Audio
F	Standby
* With Red Alarm LED CR402 on	

Table 7-6 CIM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
2[1]	Registration
2[2]	IDB Bus Access Error
3	Transmit
3[1]	Hold
3[2]	CSB Bus Access Error
4	Receive
5	Duplex Task[3]
6	Duplex Task[4]
7	Hang
7[1]	Busy Hang
8	Suspend Audio
9	Selective Disable
A	Dynamic Reassignment
B	Channel Verification
B	Interrogate
C	Dial Tone
C	DTMF Confirmation
D	Ring
E	All Call
E	End Call
F	Standby

1 With Green LED CR401 on.
2 With Red Alarm LED CR402 on.
3 Rx/Tx with different Home, Group and Site.
4 Rx/Tx with same Home, Group and Site.

Table 7-7 TIM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
3	Incoming Seize
4	TIM Incoming
5	Incoming Channel Unique ID
7	DIM Incoming Conversation
8	TIM Outgoing
9	Channel Conversation
C	End Call
D	SNM Incoming Conversation
E	Incoming Channel Group ID
F	Standby
F*	No Trunk

* With Green LED CR401 on.

Table 7-8 SNM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
2*	IDB Bus Access Error
3	Incoming Seize
4	SNM Incoming
5	Incoming Channel
6	Acquire DIM Incoming
7	DIM Incoming Conversation
8	SNM Outgoing
8**	Queue Call
9	Outgoing Channel
9**	Queue Seize
A	Queue Wait
B	Link Test
C	End Call
D	Link Wait
E	TIM Outgoing Conversation
F	Standby

* With Green LED CR401 on.
** With Red Alarm LED CR402 on.

Table 7-9 DCM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
3	Transmit
4	Receive
5	Duplex
8	Suspend Audio
F	Standby

Table 7-10 IDM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
3	Transmit
4	Receive
6	Connect PTT
7	Trunk Verification
8	Interrogate
9	Trunk Conversation
A	Facility Acquisition
B	Telephone Acquisition
B	Await Trunk
B	DIM Outgoing Conversation
C	Ring Channel
C	Channel Verification
D	Channel Conversation
E	All Call
F	Standby
F*	No Trunk
* With Green LED CR401 on.	

Table 7-11 LEM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
2*	IDB Bus Access Error
* With Red Alarm LED CR4021 on.	

Table 7-12 GPM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
2*	IDB Bus Access Error
3	Transmit
F	Standby
* With Red Alarm LED CR402 on.	

Table 7-13 VDM CARD DISPLAY/TASKS

DS1	TASK
0	Initialization
1	Await Enable
2	Idle
2*	IDB Bus Access Error
3	Transmit
F	Standby
* With Red Alarm LED CR402 on.	

Table 7-14 WAM CARD DISPLAY/TASKS

DS1	TASK
0	Not Initialized
1	Initialized but Waiting for WAC Configuration
2	WAC Configured but Idle
3	Receive Only
4	Receive of Other Transmit[1]
5	Transmit Only[2]
6	Not Used
7	Acquiring a Channel[3]
8	Full Duplex Mode[4]
[1] Console Originated Calls. [2] E-Lead Activated Call; an Outbound WAM. [3] Happens very fast, should rarely see a 7. [4] Tx and Rx; the Originating WAM.	

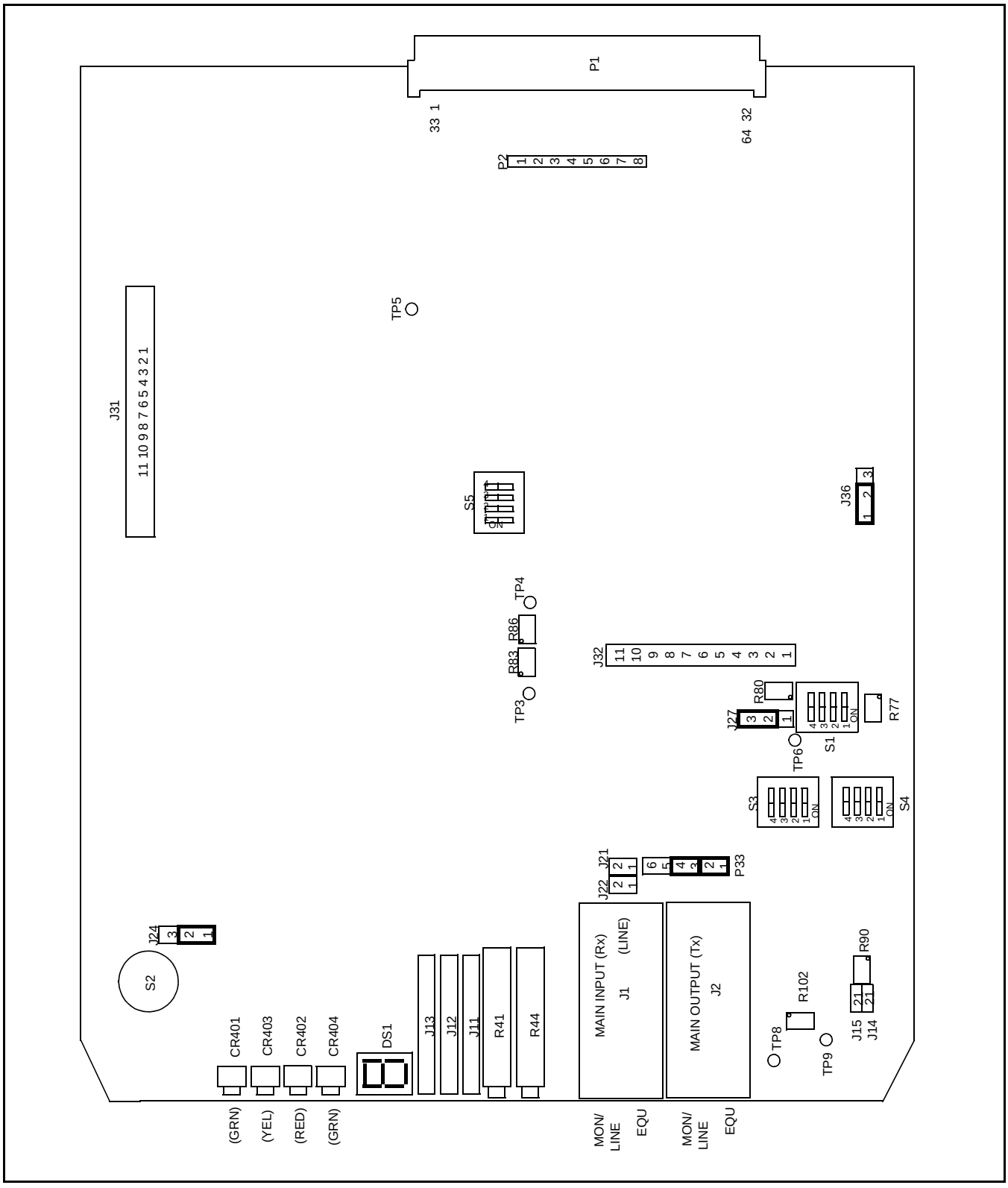


Figure 7-2 BASIC BOARD MODULE ALIGNMENT POINTS DIAGRAM

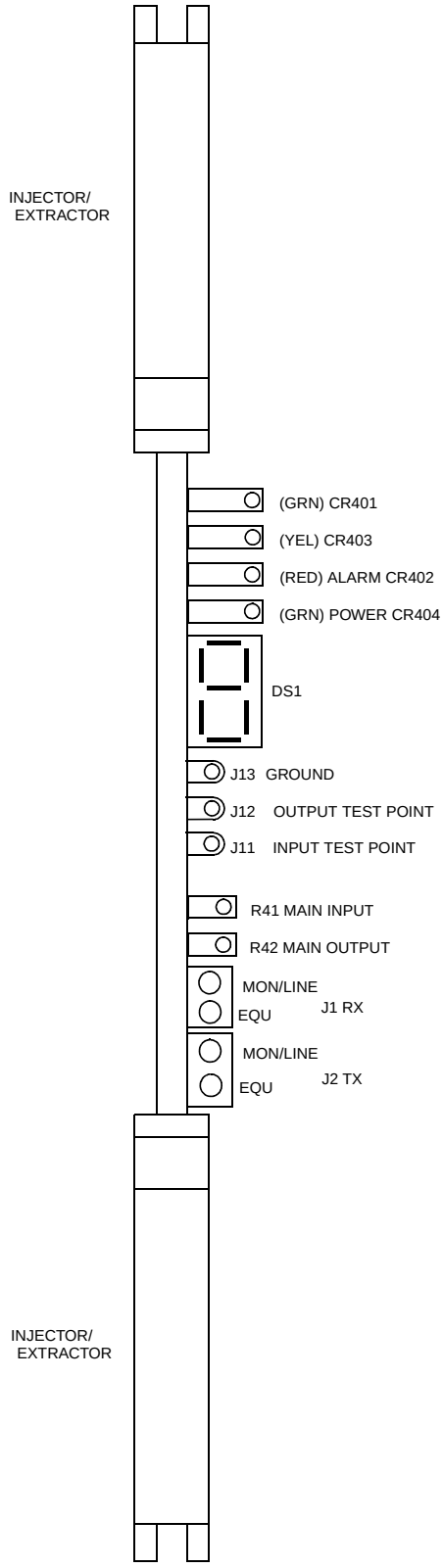


Figure 7-3 BASIC BOARD MODULE CARD EDGE LAYOUT

This page intentionally left blank.

SECTION 8 CHANNEL INTERFACE MODULE (CIM)

8.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram. The Channel Interface Module (CIM) connects the Switch to the Multi-Net and LTR Repeaters. Each repeater has a CIM that monitors and controls the repeater through logic signaling.

8.1.1 REPEATER SIGNALING

The CIM uses one of three methods to exchange control information with its repeater: RS-232 lines, Audio Frequency Shift Keying (AFSK) data on a separate audio path, or by AFSK data in a blank and burst mode on the voice audio path.

8.1.2 REPEATER CONTROL

The CIM controls the repeater with restart, enable and disable, executes requests to read and write to the repeater's memory, and tells the repeater transmit code, hang or send turnoff. The CIM receives confirmation of all requests made to the repeater and sends information the repeater receives.

8.1.3 VOICE CONNECTION

The CIM provides a 4-Wire 600 ohm balanced voice connection to the repeater, converts audio to and from Pulse Code Modulation (PCM), transmits and receives on the PCM buses, and controls voice audio gating to and from the repeater.

8.1.4 INTERNAL COMMUNICATION

The CIM uses the Intra-Terminal Data Bus (IDB) to communicate to other modules and send messages to and receive messages from the Call Processor that controls its actions.

The status of the CIM/Repeater combination is determined by the other modules by what the CIM transmits on the Channel Status Bus (CSB). The other modules monitor the CSB and determine if a CIM has the appropriate group and status for the type of communication the module requires.

8.2 CIM SETUP PROCEDURE

8.2.1 SWITCH SETTINGS

Refer to Figure 8-1 for Alignment Points Diagram.

Command and Control Communication

The command and control communication to the Multi-Net Logic Module or the Repeater Interface Module may take place by several different forms.

The form chosen is typically dependent upon the location of the repeaters to the CIM equipment.

1. If the location is within 200 feet, it is suggested that the communication take place digitally on the secondary line.

2. If the location is greater than 200 feet, the communication taking place uses the Audio Frequency Shift Keyed (AFSK) modems. This may take place on the Secondary lines if the appropriate facilities are available; i.e. 4-Wire leased line or microwave link.

3. The AFSK may be done using the blank and burst mode on the Main audio lines. This is typically used when the link is by leased lines or microwave, but the number of lines available does not allow for the use of the secondary line connections. (This has a low level burst of data (100 ms) at the end of transmissions.)

Table 8-1 CIM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
Digital Communication Using Secondary Lines								
S1	1	2	-	4	-	-	3	-
S3	1	2	-	-	-	-	3	4
S4	-	-	3	4	1	2	-	-
S5	-	-	-	-	1	2	3	4
AFSK Communication Using Secondary Lines								
S1	-	2	-	4	1	-	3	-
S3	-	-	3	4	1	2	-	-
S4	1	2	-	-	-	-	3	4
S5	-	-	-	-	1	2	3	4
AFSK Communication On The Main Line								
S1	1	-	-	4	-	2	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

8.2.2 JUMPER PLACEMENT

Table 8-2 CIM BOARD JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not Used Normal Operation
P33	1 to 2* 3 to 4* 5 6	No personality card attached No personality card attached open open
J36	1 only* 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
*Setting for Normal operation.		

8.2.3 CIM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pin-outs on the shelf backplane and wire harness pinouts.

Table 8-3 BACKPLANE PINOUTS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	RxS+
pin 28	Sec Rx -	pin 2	RxS-
pin 29	EA lead	pin 3	EA
pin 30	EB lead	pin 4	EB
pin 31	Pri Rx Audio+	pin 5	RxA+
pin 32	Pri Rx Audio-	pin 6	RxA-
		J2,4,6,8	
pin 59	Sec Tx +	TxS+	pin 1
pin 60	Sec Tx -	TxS-	pin 2
pin 61	MA lead	MA	pin 3
pin 62	MB lead	MB	pin 4
pin 63	Pri Tx Audio+	TxA+	pin 5
pin 64	Pri Tx Audio-	TxA-	pin 6

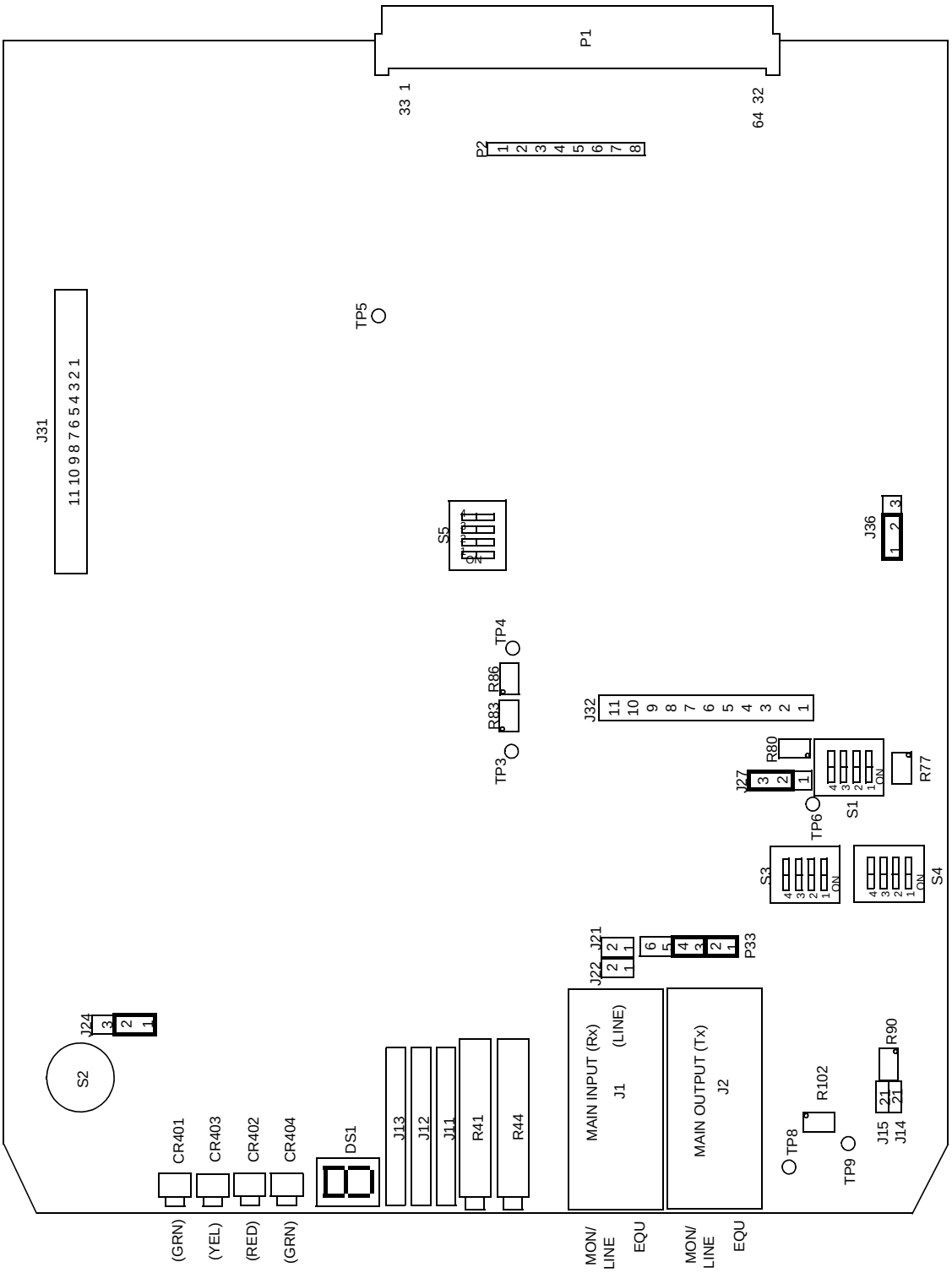


Figure 8-1 ALIGNMENT POINTS DIAGRAM

8.2.4 EXTERNAL CONNECTIONS

When connecting the CIM to a RIM or Multi-Net Logic Drawer, cross connect the Tx lines with the Rx lines. Connect the Secondary Tx and Rx lines with the Drawers Tx and Rx Data lines.

Table 8-4 CIM EXTERNAL CONNECTIONS

RIM to CIM CONNECTIONS				
Label	**TB701**	**TB702**	**CIM/ P1**	**Label**
RxDA+	pin 1		-pin 59	TxS+
RxDA-		pin 1	-pin 60	TxS-
TxDA+	pin 2		-pin 27	RxS+
TxDA-		pin 2	-pin 28	RxS-
RxA+	pin 3		-pin 63	RxA+
RxA-		pin 3	-pin 64	TxA-
TxA+	pin 4		-pin 31	RxA+
TxA-		pin 4	-pin 32	RxA-
MLM to CIM CONNECTIONS				
Label	**TB 1**	**CIM/ P1**	**Label**	
GND	1	NC		
STA1	2	-pin 31	RxA+	
STA2	3	-pin 32	RxA-	
SRA1	4	-pin 63	TxA+	
SRA2	5	-pin 64	TxA-	
SRD1	6	-pin 59	TxS+	
SRD2	7	-pin 60	TxS-	
STD1	8	-pin 27	RxS+	
STD2	9	-pin 28	RxS-	

8.3 CIM ALIGNMENT SPECIFICATIONS

8.3.1 PRE-ALIGNMENT

The CIM is pre-aligned with the Basic Board Module alignment procedures, Refer to Section 7.3.

8.3.2 CIM ALIGNMENT PROCEDURE

Connections to the CIM may take several forms as follows:

1. Direct Connection

2. Leased Lines

3. Microwave Link

4. T1 Channel Bank Interfaces
   This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.

2. Select Test 1 (S5, open section 1, close sections 2, 3 and 4).

3. Reset the module, Press S2 and release.

4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.

5. Select for normal operation (S5 all sections closed).

6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm max input, Set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.

2. Select Test 1 (S5, open section 1, close sections 2, 3 and 4).

3. Reset the module, Press S2 and release.

4. Insert an alignment tone -12 dB from the level determined in Step 1 using a 600-ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.

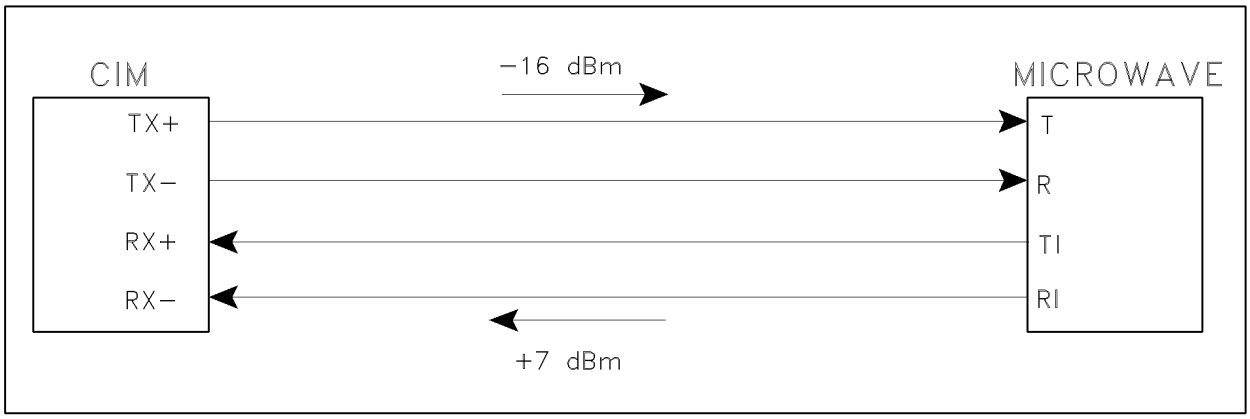


Figure 8-2 CIM INPUT AND OUTPUT LEVELS

5. Adjust R41 to be -6 dBm at J11, +6 dBm if maximum level is sent by the ancillary equipment.

6. Select for normal operation (S5 all sections closed).

7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm max output. Apply -5 dBm and set J11 for -6 dBm or apply +7 dBm, then set for +6 dBm.

Secondary Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.

2. Select Test 8 (S5, open section 4, close 1, 2 and 3).

3. Reset the module, Press S2 and release.

4. Adjust R90 for -12 dB from maximum level in Step 1 at TP9.

5. Select for normal operation (S5 all sections closed).

6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm maximum input, set TP9 for -28 dBm.

Secondary Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.

2. Select Test 8 (S5, open section 4, close sections 1, 2 and 3).

3. Reset the module, Press S2 and release.

4. Insert an alignment tone -12 dB from the level determined in Step 1 using a 600 ohm audio oscillator into RXS±, breaking the connection to the ancillary equipment. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.

5. Adjust R102 to be -12 dBm at TP8, 0 dBm if maximum level is sent by the ancillary equipment.

6. Select for normal operation (S5 all sections closed).

7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm max output. Apply -5 dBm and set TP8 for -12 dBm or if +7 dBm then set TP8 for 0 dBm.

8.4 CIM AUDIO SUMMATION PERSONALITY CARD

The CIM Audio Summation Personality Card sums the CIM card transmit and receive audio output from the external connections. This summation provides voice recording of a channel's audio. The audio is summed to require only one voice track of a logging recorder (see Figure 8-3).

8.4.1 INTERNAL CONNECTIONS

1. Remove the jumpers on P33.
2. Plug the personality card into P33.
3. Connect the wire harness to the M-lead relay, K1, pins 1 and 4.
4. Remove Q12 to ensure the M-lead is inactive.
5. Plug the wire harness into the audio summation board.

8.4.2 EXTERNAL CONNECTIONS

The summed audio is outputted on the MA and MB external connections. The appropriate track of the logging recorder is then connected to the MA and MB lines.

8.4.3 ALIGNMENT PROCEDURE

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.
2. Select Test 1 (S5, open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12. Adjust R1 for -12 dBm at EP2.
5. Select for normal operation (S5 all sections closed).
6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm max input, Set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.
2. Select Test 1 (S5, open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Insert an alignment tone -12 dB from the level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.
5. Adjust R41 to be -6 dBm at J11, +6 dBm if maximum level is sent by the ancillary equipment. Adjust R2 for -12 dBm at EP1 if average level, or 0 dBm if maximum level.
6. Select for normal operation (S5 all sections closed).
7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm max output. Apply -5 dBm and set J11 for -6 dBm or apply +7 dBm, then set for +6 dBm.

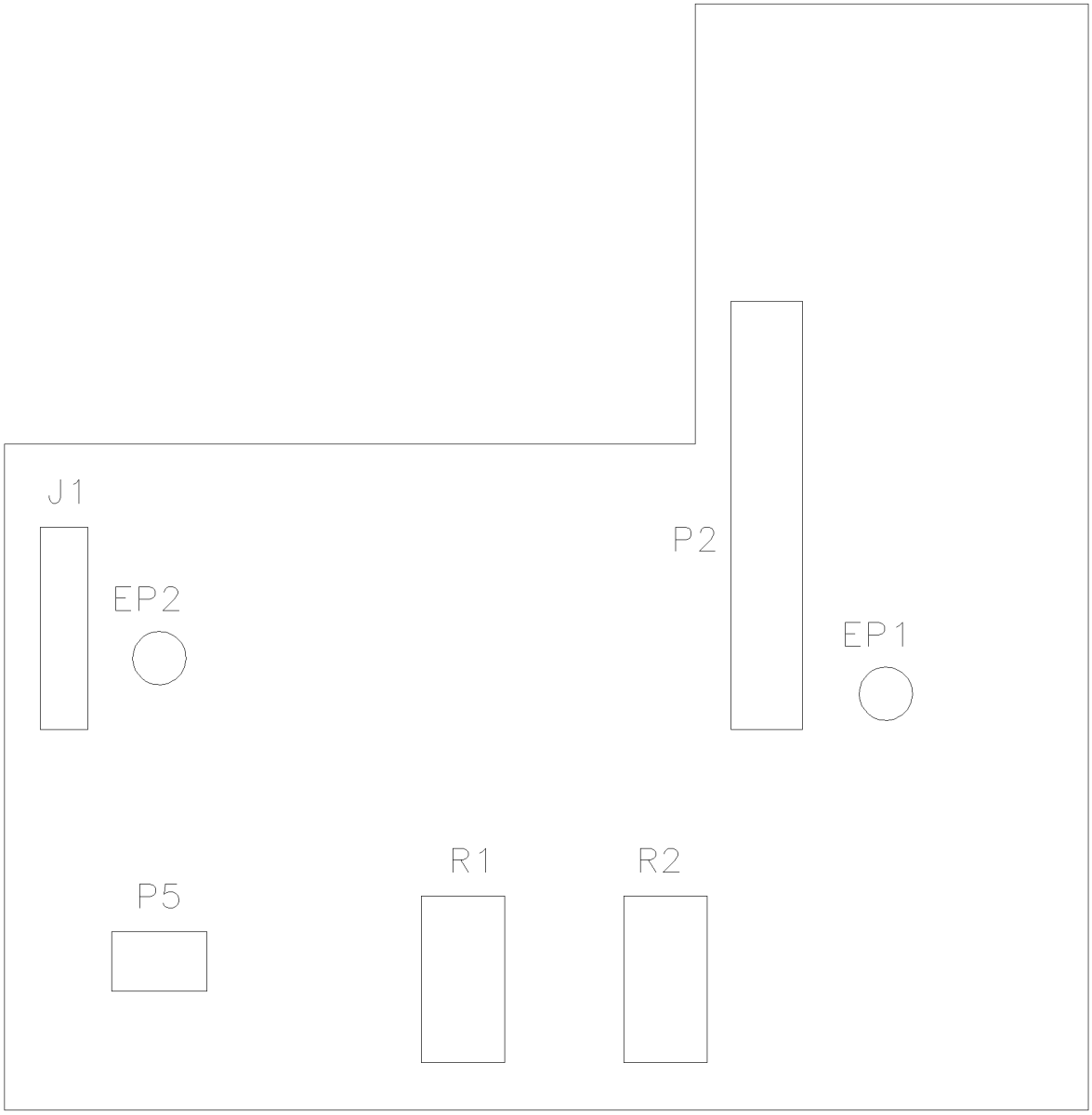


Figure 8-3 SUMMATION BOARD ALIGNMENT POINTS DIAGRAM

This page intentionally left blank.

SECTION 9 CONVENTIONAL CHANNEL MODULE (CCM)

9.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram. The Conventional Channel Module (CCM) connects the Switch to a Conventional Repeater. Each repeater has a CCM that controls the repeater through logic signaling.

9.1.1 REPEATER SIGNALING

The CCM exchanges control information with the CRM via Audio Frequency Shift Keying (AFSK) data in a blank and burst mode on the voice audio path.

9.1.2 REPEATER CONTROL

The CCM monitors and controls the repeater transmit, receives confirmation of all requests made to the repeater and sends information the repeater received.

9.1.3 VOICE CONNECTION

The CCM provides a 4-Wire 600 ohm balanced voice connection to the repeater, converts audio to and from Pulse Code Modulation (PCM), transmits and receives on the PCM buses, and controls voice audio gating to and from the repeater.

9.1.4 INTERNAL COMMUNICATION

The CCM uses the Intra-Terminal Data Bus (IDB) to communicate to other modules and send messages to and receive messages from the Call Processor that controls its actions.

The status of the CCM/CRM/Repeater combination is determined by the other modules by what the CCM transmits on the Channel Status Bus (CSB). The other modules monitor the CSB and determine if a CCM has the appropriate group and status for the type of communication the module requires.

9.2 CCM SETUP PROCEDURE

9.2.1 CCM SWITCH SETTINGS

Refer to Figure 9-1 for Alignment Points Diagram.

Command and Control Communication

The command and control communication to the Conventional Repeater Module (CRM) is by blank and burst mode of Audio Frequency Shift Keyed data on the Main audio lines.

9.2.2 AFSK COMMUNICATION ON THE MAIN LINES

Refer to Table 9-1 for switch settings.

Table 9-1 CCM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	-	-	4	-	2	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

9.2.3 CCM JUMPER PLACEMENT

Table 9-2 CCM JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not used Normal operation
P33	1 to 2 3 to 4 5 and 6	open open open
J36	1 only 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Indicates normal operation.		

9.2.4 CCM BACKPLANE EXTERNAL CONTACTS

See Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

Table 9-3 CCM EXTERNAL CONNECTIONS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	RxS+
pin 28	Sec Rx -	pin 2	RxS-
pin 29	EA lead	pin 3	EA
pin 30	EB lead	pin 4	EB
pin 31	Pri Rx Audio+	pin 5	RxA+
pin 32	Pri Rx Audio-	pin 6	RxA-
		J2,4,6,8	
pin 59	Sec Tx +	TxS+	pin 1
pin 60	Sec Tx -	TxS-	pin 2
pin 61	MA lead	MA	pin 3
pin 62	MB lead	MB	pin 4
pin 63	Pri Tx Audio+	TxA+	pin 5
pin 64	Pri Tx Audio-	TxA-	pin 6

9.3 CCM ALIGNMENT SPECIFICATIONS

9.3.1 PRE-ALIGNMENT

The CCM is pre-aligned with the Basic Board Module alignment procedures, Refer to Section 7.3.

9.3.2 CCM ALIGNMENT PROCEDURE

Connections to the CCM may take several forms:

1. Direct Connection
2. Leased Lines
3. Microwave Link
4. T1 Channel Bank Interfaces

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.
2. Select Test 1 (S5, open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.
5. Select for normal operation (S5 all sections closed).
6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm max input, Set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.
2. Select Test 1 (S5, open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Insert the maximum level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the maximum level alignment tone to the interface module.
5. Adjust R41 to be -6 dBm at J11.
6. Adjust R102 to be 0 dBm at TP8.
7. Select for normal operation (S5 all sections closed).
8. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm maximum output, set J11 for -5 dBm.

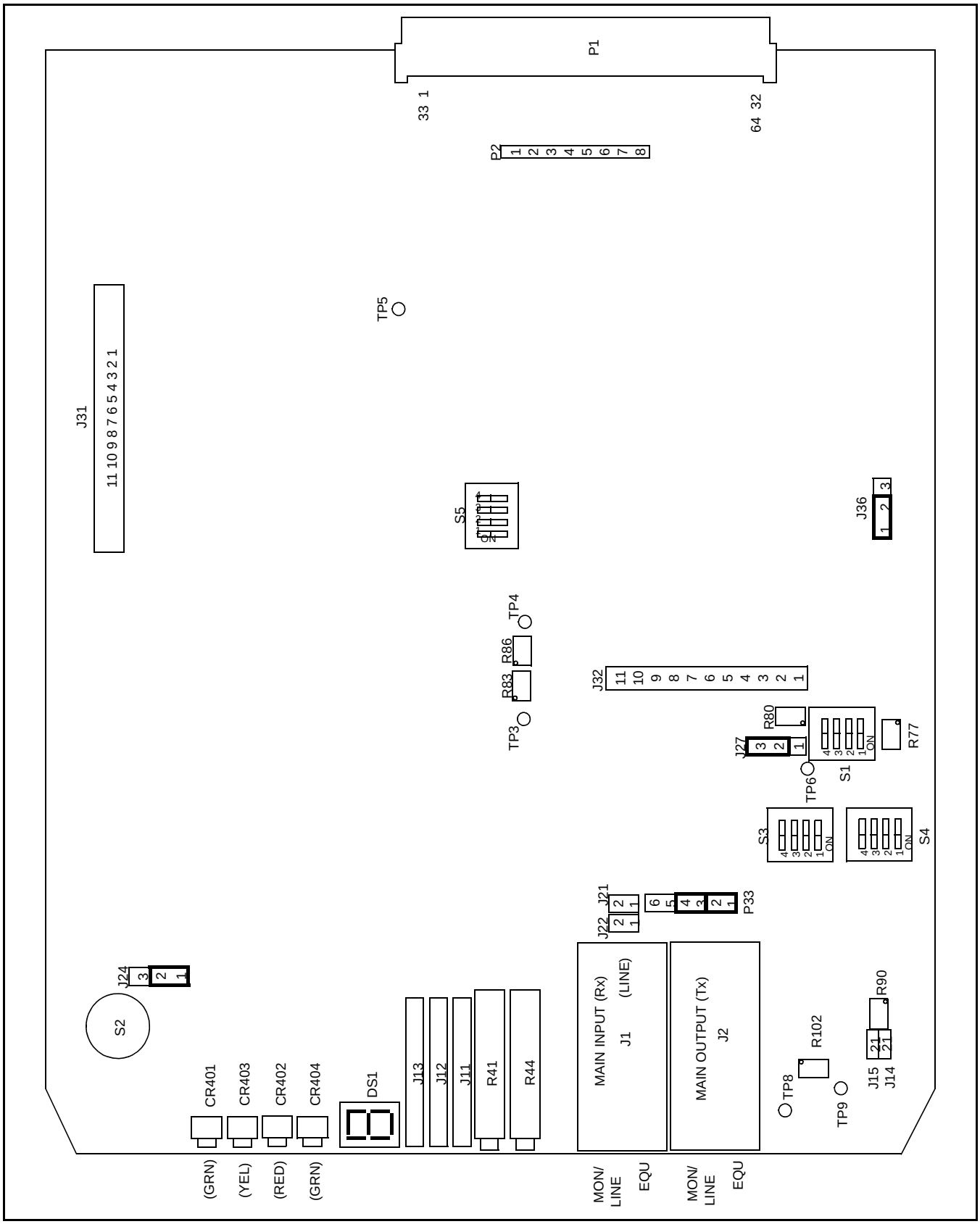


Figure 9-1 ALIGNMENT POINTS DIAGRAM

This page intentionally left blank.

SECTION 10 DISPATCH CHANNEL MODULE (DCM)

10.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram. The Dispatch Channel Module (DCM) connects the Switch to a Conventional Repeater. Each repeater has a DCM that controls the repeater through logic signaling.

10.1.1 REPEATER SIGNALING

The DCM exchanges control information with the CRM via Audio Frequency Shift Keying (AFSK) data in a blank and burst mode on the voice audio path.

10.1.2 REPEATER CONTROL

The DCM monitors and controls the repeater transmit, receives confirmation of all requests made to the repeater and sends information the repeater received.

10.1.3 VOICE CONNECTION

The DCM provides a 4-Wire 600 ohm balanced voice connection to the repeater, converts audio to and from Pulse Code Modulation (PCM), transmits and receives on the PCM buses, and controls voice audio gating to and from the repeater.

10.1.4 INTERNAL COMMUNICATION

The DCM uses the Intra-Terminal Data Bus (IDB) to communicate to other modules and send messages to and receive messages from the Call Processor that controls its actions.

The DCM monitors the CSB to determine if a CIM is active with the appropriate group.

10.2 DCM SETUP PROCEDURE

10.2.1 DCM SWITCH SETTINGS

Refer to Figure 10-1 for the Alignment Points Diagram.

Command and Control Communication

The command and control communication to the Conventional Repeater Module (CRM) is by blank and burst mode of Audio Frequency Shift Keyed data on the Main audio lines.

10.2.2 AFSK COMMUNICATION ON THE MAIN LINES

Refer to Table 10-1 for switch settings.

Table 10-1 DCM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	-	-	4	-	2	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

10.2.3 DCM JUMPER PLACEMENT

Table 10-2 DCM JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not used Normal operation
P33	1 to 2 3 to 4 5 and 6	open open open
J36	1 only 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Indicates normal operation.		

10.2.4 DCM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

Table 10-3 DCM EXTERNAL CONNECTIONS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	RxS+
pin 28	Sec Rx -	pin 2	RxS-
pin 29	EA lead	pin 3	EA
pin 30	EB lead	pin 4	EB
pin 31	Pri Rx Audio+	pin 5	RxA+
pin 32	Pri Rx Audio-	pin 6	RxA-
		J2,4,6,8	
pin 59	Sec Tx +	TxS+	pin 1
pin 60	Sec Tx -	TxS-	pin 2
pin 61	MA lead	MA	pin 3
pin 62	MB lead	MB	pin 4
pin 63	Pri Tx Audio+	TxA+	pin 5
pin 64	Pri Tx Audio-	TxA-	pin 6

10.3 DCM ALIGNMENT SPECIFICATIONS

10.3.1 PRE-ALIGNMENT

The DCM is pre-aligned with the Basic Board Module alignment procedures (refer to Section 7.3).

10.3.2 DCM ALIGNMENT PROCEDURE

Connections to the DCM may take several forms:

1. Direct Connection
2. Leased Lines
3. Microwave Link
4. T1 Channel Bank Interfaces

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.
2. Select Test 1 (S5, open section 1, close sections 2, 3 and 4)
3. Reset the module, Press S2 and release.
4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.
5. Select for normal operation (S5 all sections closed).
6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm max input, set J12 for -28 dBm.

Main Receive

Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.

1. Select Test 1 (S5, open section 1, close sections 2, 3 and 4).
2. Reset the module, Press S2 and release.
3. Insert the maximum level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the maximum level alignment tone to the interface module.
4. Adjust R41 to be -6 dBm at J11.
5. Adjust R102 to be 0 dBm at TP8.
6. Select for normal operation (S5 all sections closed).
7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm maximum output, set J11 for -5 dBm.

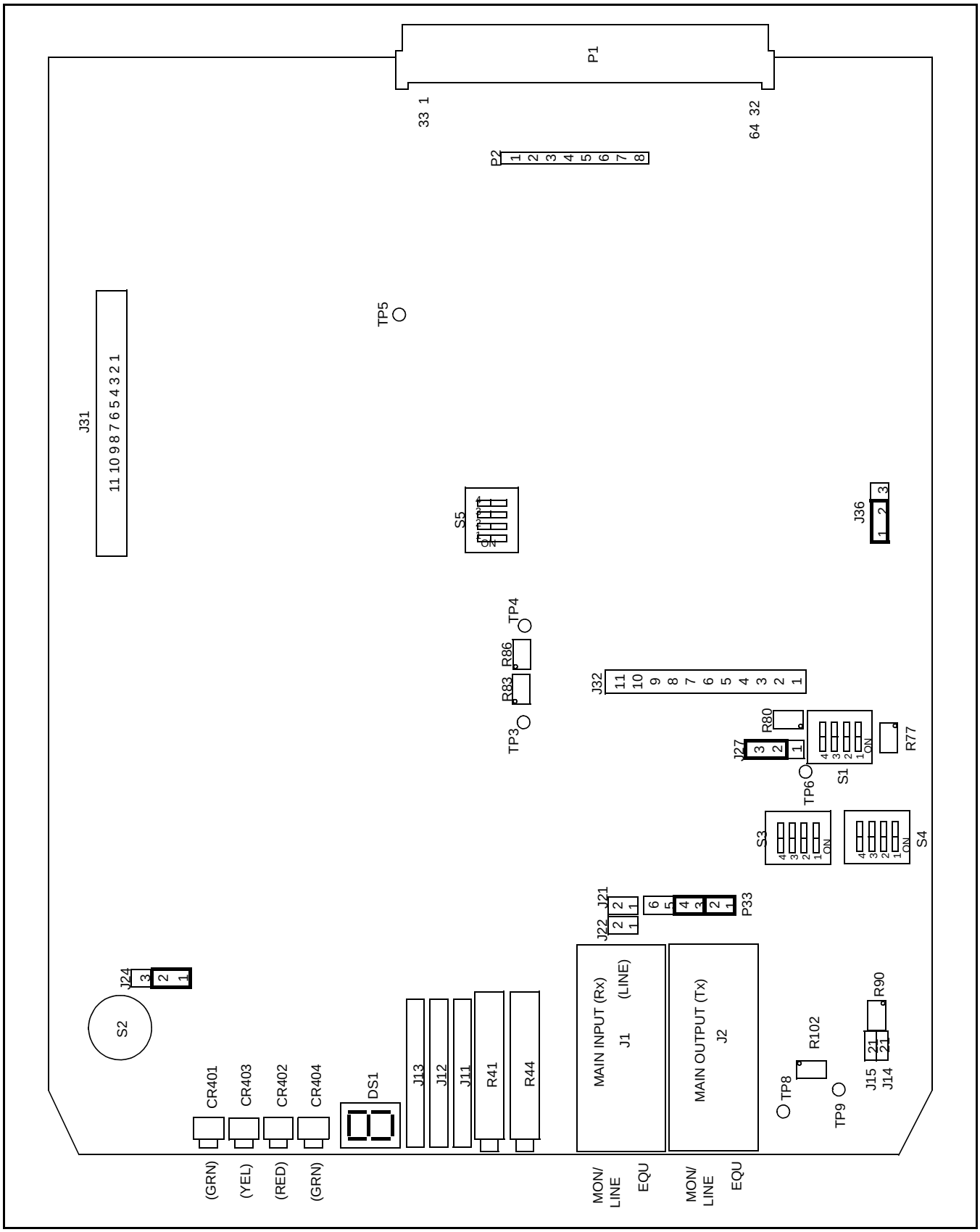


Figure 10-1 ALIGNMENT POINTS DIAGRAM

This page intentionally left blank.

SECTION 11 DISPATCH INTERFACE MODULE (DIM)

11.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram. The Dispatch Interface Module (DIM) uses one of two methods of interface to the dispatch equipment:

1. Direct Connection

2. Tone Remote

A DIM with direct connection is associated with only one group code and uses a form of Type II E&M lead input similar to the mobile PTT.

A DIM with tone remote connection decodes guard tone for the PTT indication and decodes DTMF to select from one of ten group codes. A control sequence uses the DTMF to place the DIM in scan mode or to stop and use a specific group code. The tone remote feature requires the use of a plug-in personality card.

The DIM connects the 4-Wire 600 ohm balanced audio with the Pulse Code Modulation (PCM) data paths and communicates to other modules via the Intra-Terminal Data Bus (IDB). The DIM also monitors the Channel Interface Module (CIM) Channel Status Bus (CSB) to determine if a CIM is active with a DIM group.

11.2 DIM SETUP PROCEDURE

11.2.1 SWITCH SETTINGS

Refer to Figure 11-1 for Alignment Points Diagram.

Command and Control Communication

The command and control communication to the Consoles may take the place by two different forms. The form chosen is typically dependent upon the type of console connected to the DIM.

1. If the Console is a normal contact closure PTT, the connection is by direct connect. This uses the E&M lead input and output.

2. A Tone Remote Console uses 4-Wire audio for the connection. The DIM requires the use of a tone remote personality card.

Table 11-1 DIM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
Direct Connection								
S1	1	2	-	4	-	-	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4
Tone Remote								
S1	1	2	3	4	-	-	-	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

11.2.2 DIM JUMPER PLACEMENT

Table 11-2 DIM BOARD JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not Used Normal Operation
P33	1 to 2* 3 to 4* 5 6	No personality card attached No personality card attached open open
J36	1 only* 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
*Setting for Normal operation.		

Table 11-3 BACKPLANE PLACEMENT

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	RxS+
pin 28	Sec Rx -	pin 2	RxS-
pin 29	EA lead	pin 3	EA
pin 30	EB lead	pin 4	EB
pin 31	Pri Rx Audio+	pin 5	RxA+
pin 32	Pri Rx Audio-	pin 6	RxA-
		J2,4,6,8	
pin 59	Sec Tx +	TxS+	pin 1
pin 60	Sec Tx -	TxS-	pin 2
pin 61	MA lead	MA	pin 3
pin 62	MB lead	MB	pin 4
pin 63	Pri Tx Audio+	TxA+	pin 5
pin 64	Pri Tx Audio-	TxA-	pin 6

11.2.3 E-LEAD SELECTION

If the PTT from the console is an open contact relay, either of the above options for J36 may be used.

If the PTT is a closure to ground with a pull-up resistor to a positive voltage, J36, pin 2 should be connected to ground without connection to pin 1 or pin 3.

11.2.4 DIM BACKPLANE EXTERNAL CONTACTS

See Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

11.3 DIM ALIGNMENT SPECIFICATION

11.3.1 PRE-ALIGNMENT

The DIM is pre-aligned with the Basic Board Module alignment procedures (Refer to Section 7.3). The tone remote personality card should be removed and P33 jumpered accordingly for the proper pre-alignment of the module (Refer to Table 11-2).

11.3.2 PRE-ALIGNMENT WITH TONE REMOTE PERSONALITY CARD

Set the module for pre-alignment by referring to Table 11-1, Alignment Points Diagram Figure 7-2, and Figure 11-1.

1. Set the card Tone Remote PTT level alignment:

   a. Inject 2175 Hz ±1 Hz at 0 dBm into EQU of Rx input J1.

   b. Open S1 (Sections 1, 2, 3 and 4).

   c. Set S5 for Test 1 (Open section 1, close section 2, 3 and 4).

   d. Reset the module, press S2 and release.

5. Main Rx audio level from J1:

   a. Setup for alignment as in Step 1.

   b. Adjust R41 to -6 dBm ±0.5 dB at J11.

3. Tone Remote Personality Card:

   a. Adjust R207 for a minimum at EP221. (Should be < -15 dBm.)

   b. Adjust R228 for 0 dBm ±0.5 dB at EP224.

   c. Adjust R236 for a peak level at EP225.

   d. Adjust R272 for a peak level at EP227.

   e. Verify EP228/EP229 are high (> 4.5V).

   f. Reduce the level of the 2175 Hz tone until EP228 goes low (< 0.8V). Verify the level of the 2175 Hz tone is -10 dBm ±2 dB.

   g. Verify that EP229 is still high (> 4.5V).

   h. Reduce the level of the 2175 Hz tone until EP229 goes low (< 0.8V). Verify the level of the 2175 Hz tone is -40 dBm ±2 dB.

   i. Change the frequency and level of the input tone to 1004 Hz at -12 dBm.

   j. Verify that the level at J11 is -6 dBm ±1 dB.

   k. Verify that the level at EP221 is -6 dBm ±1 dB.

   l. Verify that the level at TP5 is -6 dBm ±1 dB.

   m. Adjust R211 for -12 dBm ±1 dB at EP222.

14. Main Tx Audio Output Level From J1.

    a. Setup for alignment as in Step 1.

    b. Adjust R83 for a -3 dBm ±0.5 dB level at TP3.

    c. Adjust R44 for a -12 dBm ±0.5 dB level at J12.

4. Tone Remote PTT Tone Output Level.

    a. Set S5 for Test 2 (open section 2, close 1, 3 and 4).

    b. Reset the module, Press S2 and release.

    c. Adjust R267 for +8 dBm ±0.5 dB at EP226.

    d. Verify the level at J12 to be -1 dBm ±1 dB.

5. DTMF Encoder Level of the Tone Remote Card.

    a. Set S5 for Test 3 (open sections 1 and 2, close 3 and 4).

    b. Reset the module, Press S2 and release.

    c. Adjust R216 for -3 dBm ±0.5 dB at EP223.

    d. Verify the level at J12 to be -12 dBm ±1 dB.

5. Normal Operation

    a. Set S5 to 0, normal operation (sections 1, 2, 3 and 4 closed).

    b. Reset the module, Press S2 and release.

    c. Remove the input alignment tone from J1.

NOTE: FSK is not aligned since it is not used on the DIM.

11.4 ALIGNMENT

Connections to the DIM may take several forms:

1. Direct Connection.

2. Leased Lines.

3. Microwave Link.

4. T1 Channel Bank Interfaces.

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.

2. Set S5 to Test 1 (open section 1, close sections 2, 3 and 4)

3. Reset the module, Press S2 and release.

4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.

5. Set S5 for normal operation (all sections closed).

6. Reset the module, Press S2 and release.

    Example: Microwave has -16 dBm max input, set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.

2. Set S5 to Test 1 (open section 1, close sections 2, 3 and 4).

3. Reset the module, Press S2 and release.

4. Insert the maximum level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.

5. Adjust R41 to be -6 dBm at J11.

6. Set S5 for normal operation (all sections closed).

7. Reset the module, press S2 and release.

    Example: Microwave has +7 dBm maximum output, set J11 for -5 dBm.

Secondary Transmit and Receive

Not aligned since the DIM does not use FSK signaling.

11.5 TONE REMOTE DTMF OPERATION

The following formats are the valid sequences of DTMF control. "N" is the digits 0 through 9.

Press the starting digit.

The tone remote console automatically keys, hold this first digit for 1 second to ensure the tone remote keys and passes the digit.

Press the additional digits.

A confirmation tone is heard if the digit sequence was accepted.

Table 11-4 TONE REMOTE FORMATS

Function	Digits
Start Scan	**
Stop Scan (Group Select)	#N
Enable List N	*N*
Disable List N	*N#
Enable All	*#

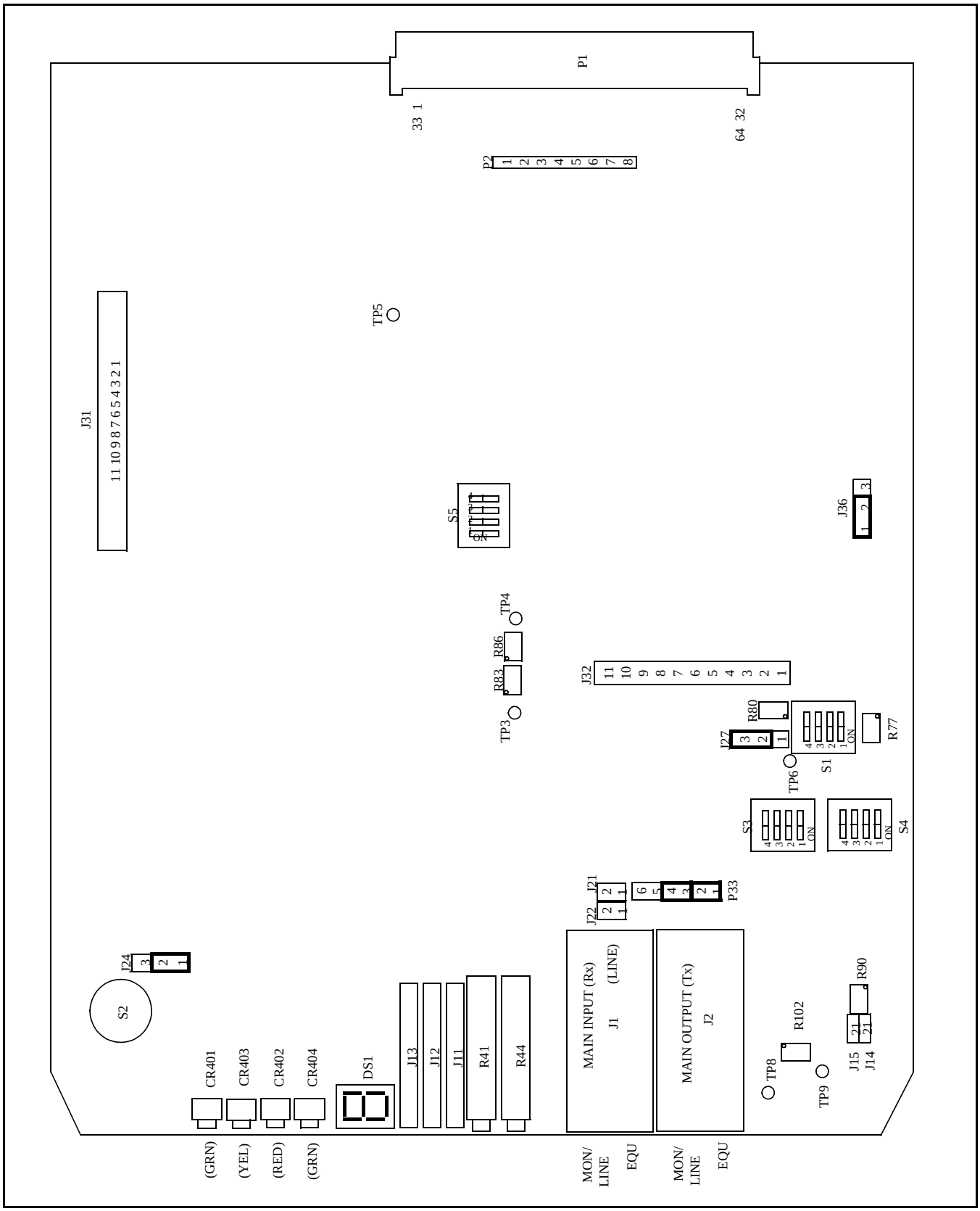


Figure 11-1 ALIGNMENT POINTS DIAGRAM

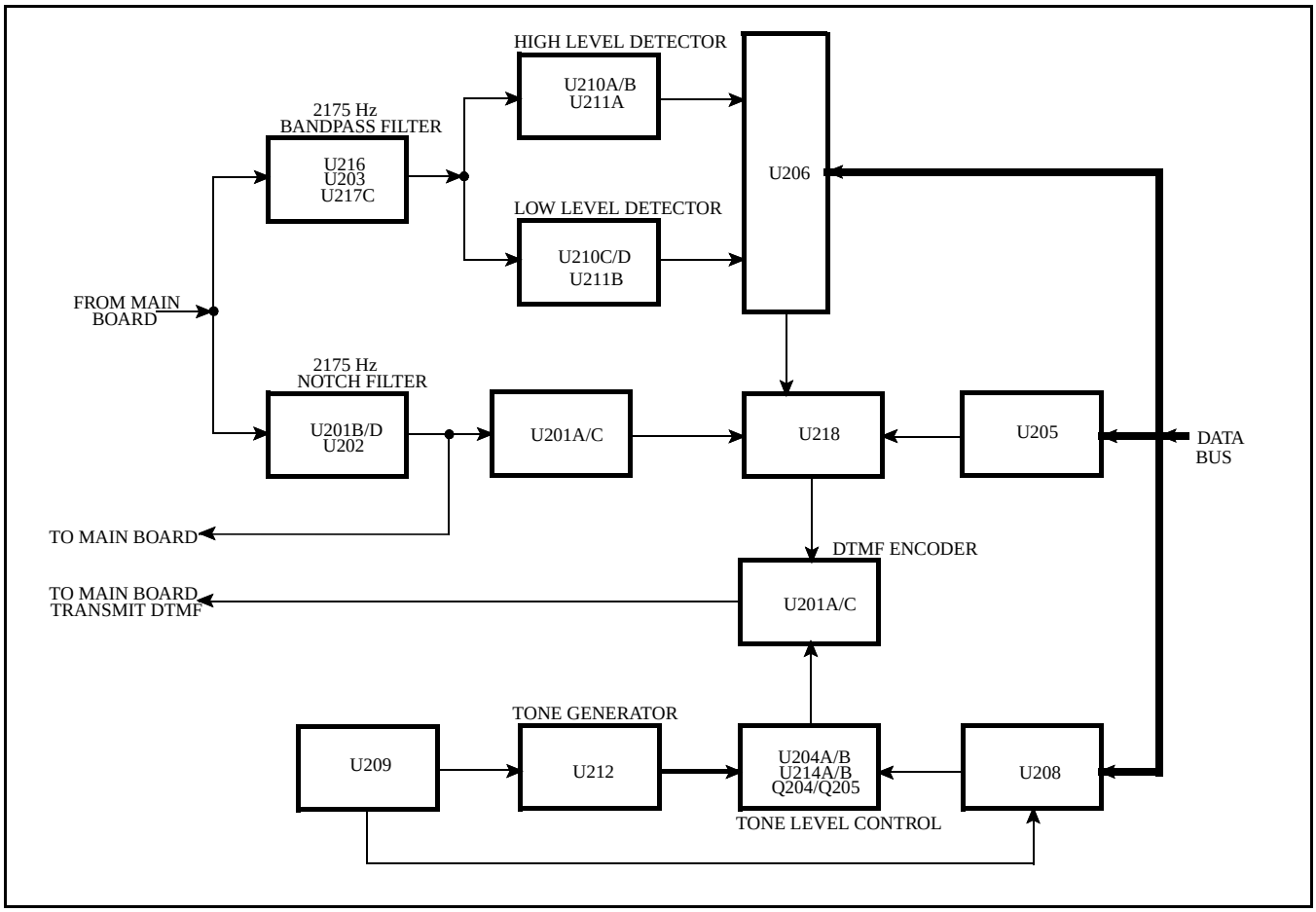


Figure 11-2 PTT TONE REMOTE CARD BLOCK DIAGRAM

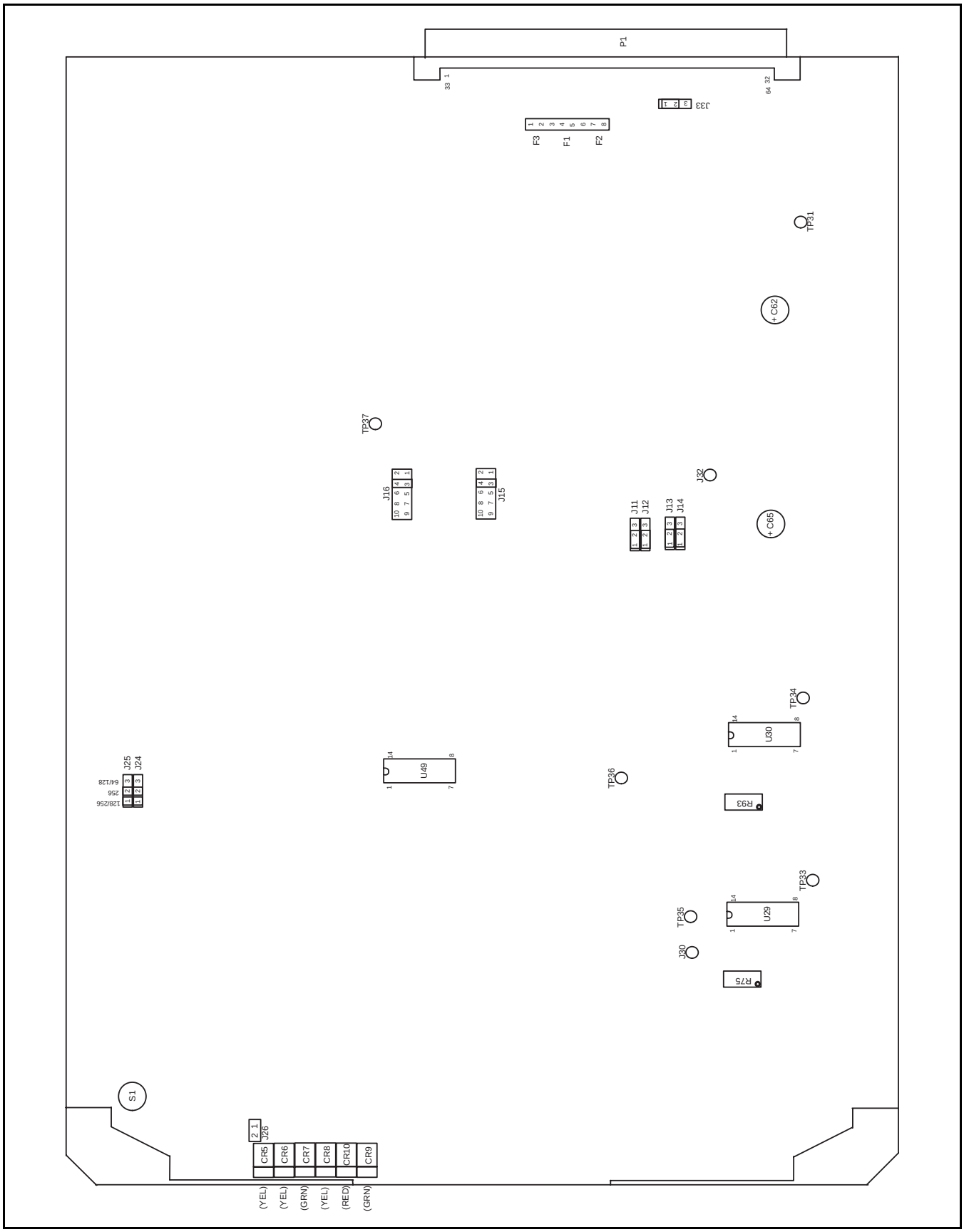


Figure 11-3 PTT TONE REMOTE CARD ALIGNMENT POINTS DIAGRAM

This page intentionally left blank.

SECTION 12 INTELLIGENT DISPATCH MODULE (IDM)

12.1 DESCRIPTION

Refer to 3000 Series Switch Service Information Manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram. The Intelligent Dispatch Module (IDM) interfaces to a Multi-Net II dispatch console.

The IDM has a digital data connection that requires a separate full duplex 9600 baud RS-232 interface called the Intelligent Dispatch Interface Bus (IDIB). The separate data path is required to allow the computer controlled dispatch console(s) to monitor and display the status of other groups. This status and display update can take place while the console is busy with voice communication on another group. The information exchanged between the IDM and the console(s) controls what the IDM receives and transmits for voice communication.

The IDM connects the 4-wire, 600-ohm balanced audio with the Pulse Code Modulation (PCM) data paths and communicates to other modules via the Intra-Terminal Data Bus (IDB). The IDM also monitors the Channel Status Bus (CSB) to send update changes to the IDM via the IDIB.

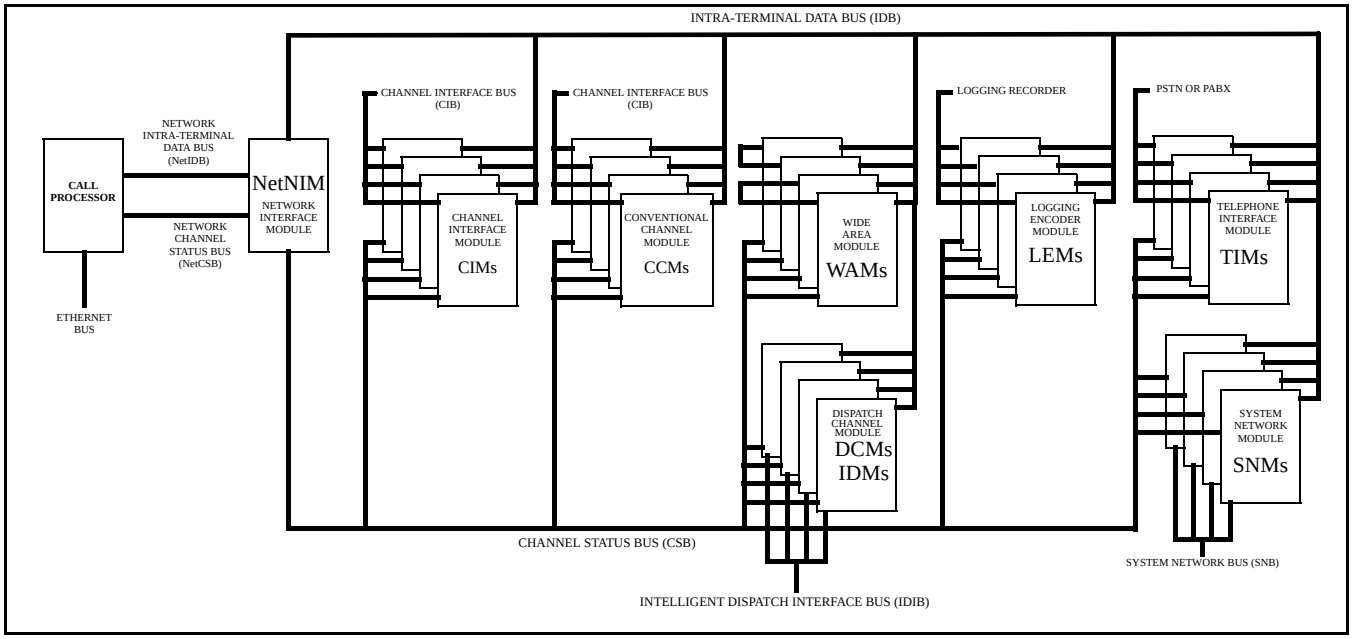


Figure 12-1 IDM DATA BUS

12.2 IDM SETUP PROCEDURE

12.2.1 SWITCH SETTINGS

Refer to Figure 12-2 for Alignment Points Diagram.

Command and Control Communication

The command and control communication to the Consoles takes place on a digital RS-232 link at 9600 baud. The digital link occurs on the Secondary lines.

Table 12-1 IDM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	2	-	4	-	-	3	-
S3	1	2	-	-	-	-	3	4
S4	-	-	3	4	1	2	-	-
S5	-	-	-	-	1	2	3	4

12.2.2 IDM JUMPER PLACEMENT

Table 12-2 IDM BOARD JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not Used Normal Operation
P33	1 to 2* 3 to 4* 5 6	No personality card attached No personality card attached open open
J36	1 only* 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
*Setting for Normal operation.		

12.2.3 IDM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

Table 12-3 BACKPLANE PINOUTS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	Signal
pin 28	Sec Rx -	pin 2	Ground
pin 29	EA lead	pin 3	
pin 30	EB lead	pin 4	
pin 31	Pri Rx Audio+	pin 5	
pin 32	Pri Rx Audio-	pin 6	
		J2,4,6,8	
pin 59	Sec Tx +	Signal	pin 1
pin 60	Sec Tx -	Ground	pin 2
pin 61	MA lead		pin 3
pin 62	MB lead		pin 4
pin 63	Pri Tx Audio+		pin 5
pin 64	Pri Tx Audio-		pin 6

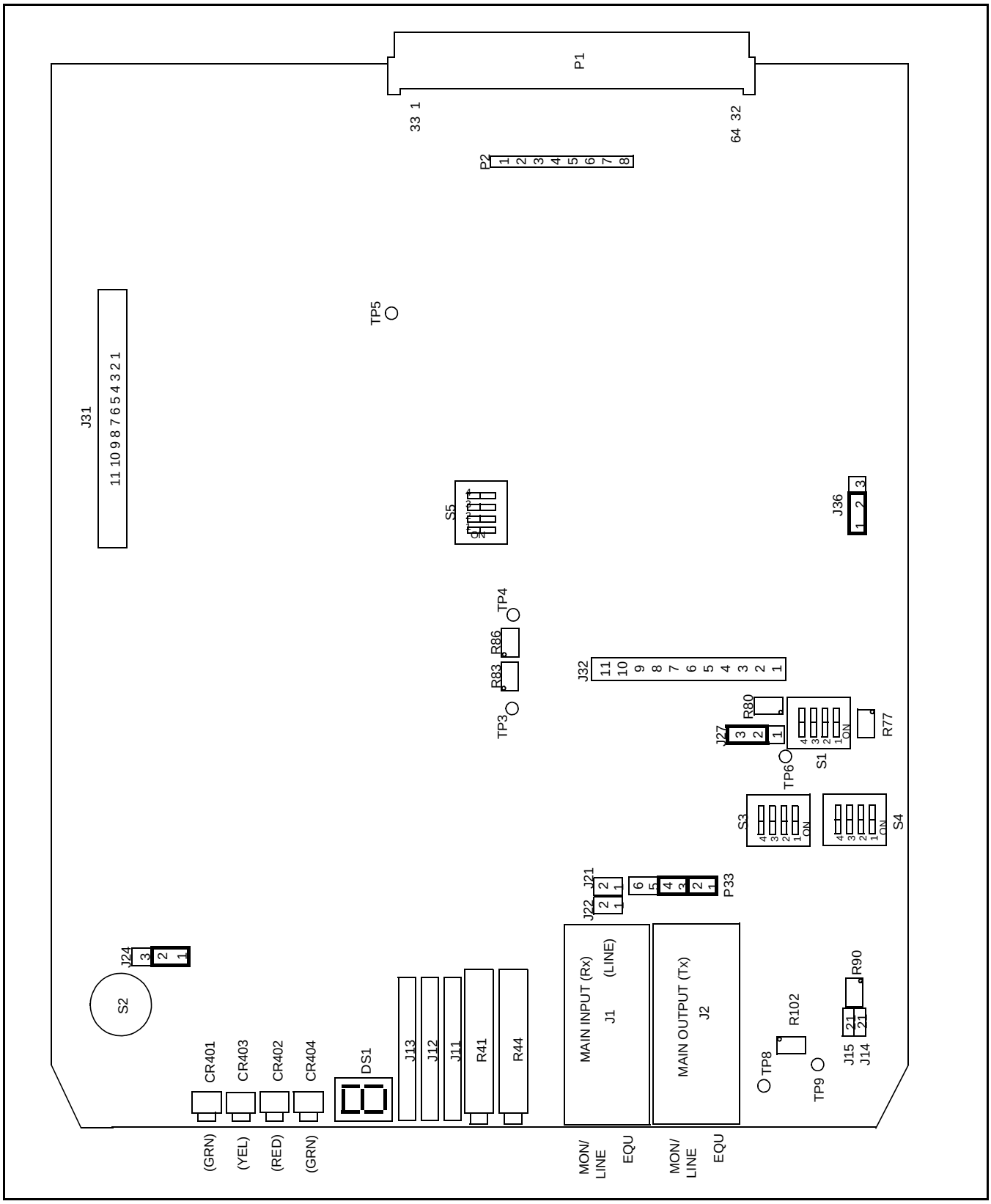


Figure 12-2 ALIGNMENT POINTS DIAGRAM

12.3 IDM ALIGNMENT SPECIFICATION

12.3.1 PRE-ALIGNMENT

The IDM is pre-aligned with the Basic Board Module alignment procedures, refer to Section 7.3.

1. Main Rx Audio Level From J1:

   a. Setup for alignment, input 1004 Hz tone at -12 dBm into J1 EQU.

   b. Set S5 for Test 1 (open section 1; close 2, 3 and 4).

   c. Reset the module, press S2 and release.

   d. Adjust R41 to -6 dBm ±0.5 dB at J11.

   e. Verify that the level at TP5 is -6 dBm ±1 dB.

6. Main Tx Audio Output Level From J1:

   a. Setup for alignment as in Step 1.

   b. Adjust R83 for a -3 dBm ±0.5 dB level at TP3.

   c. Adjust R44 for a -12 dBm ±0.5 dB level at J12.

4. Normal Operation:

   a. Set S5 to 0, normal operation (Close sections 1, 2, 3 and 4).

   b. Reset the module, Press S2 and release.

   c. Remove the input alignment tone from J1.

   NOTE: FSK is not aligned since it is not used on the IDM.

12.4 ALIGNMENT

Connections to the IDM may take several forms:

- Direct Connection
- Leased Lines
- Microwave Link
- T1 Channel Bank Interfaces

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.

2. Set S5 to Test 1 (open section 1, close sections 2, 3 and 4).

3. Reset the module, press S2 and release.

4. Adjust R44 for -12 dB from the maximum level in step 1 at J12.

5. Set S5 for normal operation (all sections closed).

6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm maximum input, set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.

2. Set S5 to Test 1 (open section 1, close sections 2, 3 and 4)

3. Reset the module, press S2 and release.

4. Insert the maximum level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.

5. Adjust R41 to be -6 dBm at J11.

6. Set S5 for normal operation (all sections closed).

7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm maximum output, set J11 for -5 dBm.

Secondary Transmit and Receive

Not aligned since the IDM does not use FSK signaling.

12.5 PCM SUMMATION PERSONALITY CARD

The PCM Summation Personality Card sums multiple time slots on the PCM audio bus for the unselect audio for the Multi-Net Tracer Series of consoles (see Figure 12-3).

12.5.1 INTERNAL CONNECTIONS

1. Plug the personality card into J32.

2. Plug the personality card into the piggyback bus via J31.

3. Connect a wire harness to:
   Rx PCM Primary U26, pin 13 (Blk)
   Master Clock U26, pin 9 (Wht)
   Master Sync U26, pin 7 (Red)

4. Connect the summed audio using a wire harness to M-lead relay K1, pin 1 (Wht) and pin 4 (Red).

5. Remove Q12 to ensure the M-lead is inactive.

6. Plug the wire harness into the audio summation board.

12.5.2 EXTERNAL CONNECTIONS

The summed audio output is on the MA and MB external connections. The unselect audio is then connected to the MA and MB leads.

12.5.3 ALIGNMENT PROCEDURE

1. Set CIM S5 to Test 9 (open section 1-4, close 2-3).

2. Set IDM S5 to Test 9 (open section 1-4, close 2-3).

3. Adjust R1 for +2.5 dBm at TP1 on the PCM Summation card.

4. Adjust R25 for -3 dBm at TP2 on the PCM Summation card.

5. Set S5 on CIM and IDM (all closed).

6. Reset each module, Press S2 and release.

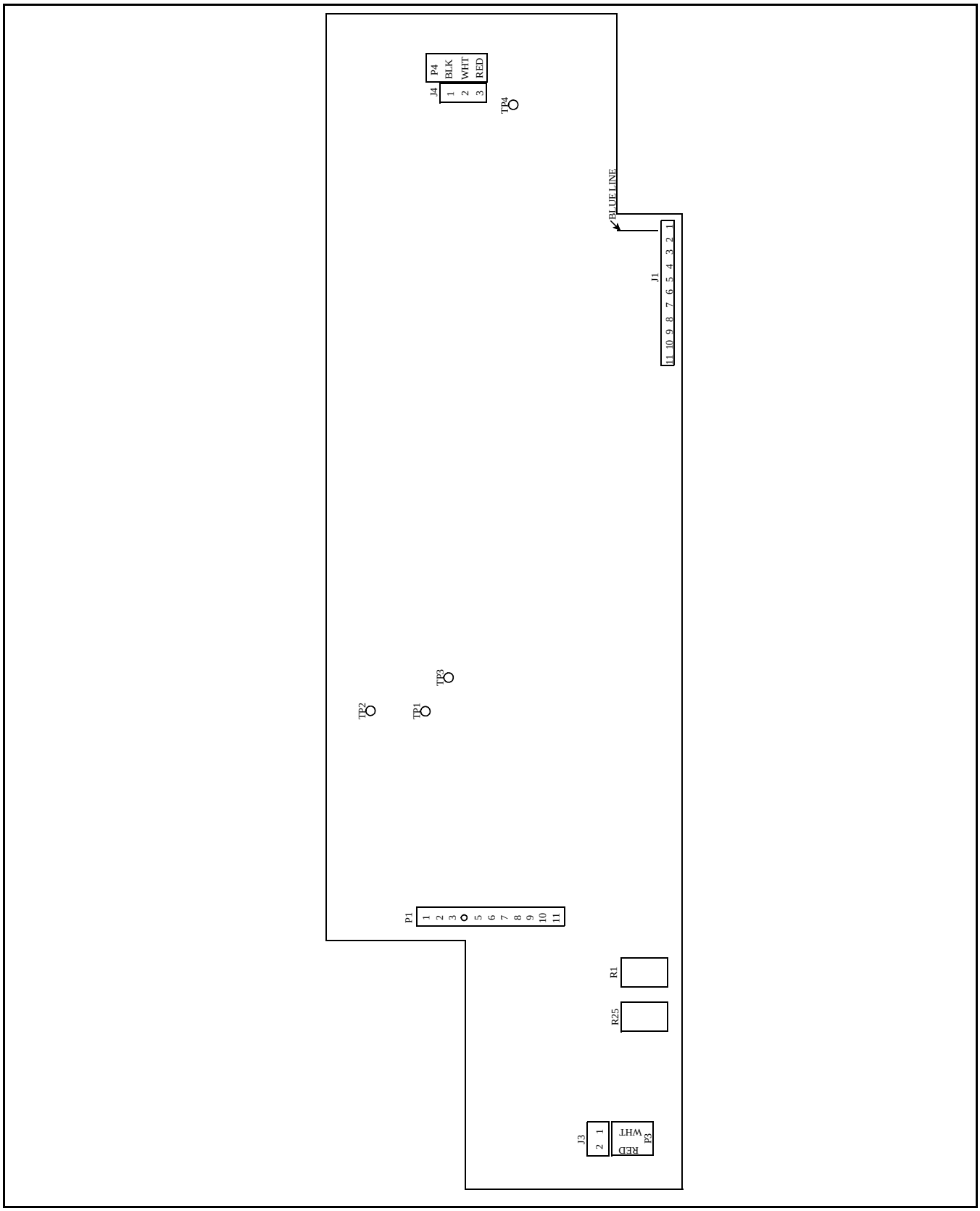


Figure 12-3 SUMMATION BOARD ALIGNMENT POINTS DIAGRAM

SECTION 13 SYSTEM NETWORK MODULE (SNM)

13.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram. The System Network Module (SNM) is the interface that allows Unique ID calling from RF units and multiple Switches to be connected in a total system network.

The SNM uses a 4-wire 600 ohm balanced audio on the interface and connects audio to the PCM data paths. The SNM also uses a Type II E&M lead connection set for connection initiation and supervision.

The SNM communicates with other modules via the Intra-Terminal Data Bus (IDB) and monitors the Channel Status Bus (CSB) for the group set up to use the SNM.

SNMs pass information on the interface relative to the type of call desired and connection status of the end device, using Audio Frequency Shift Keying (AFSK) data in a blank and burst mode. This form of data passing allows a standard 4-Wire interface connection and does not require a specialized system switching node.

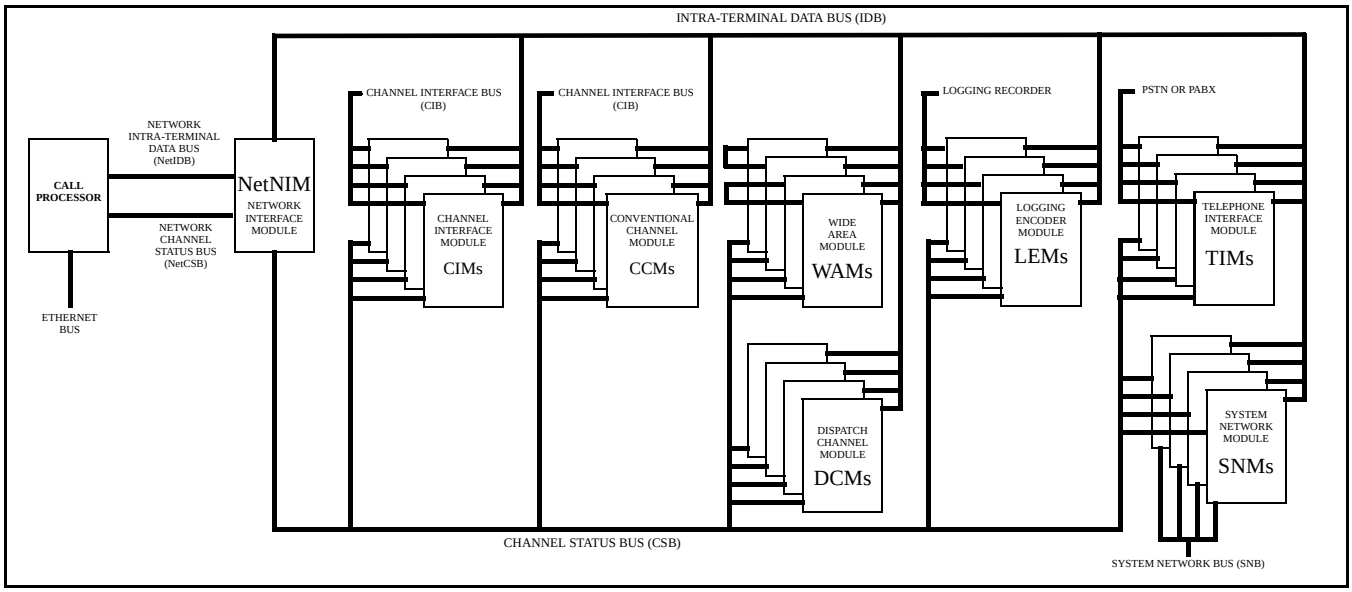


Figure 13-1 DATA BUS BLOCK DIAGRAM

13.2 SNM SETUP PROCEDURE

13.2.1 SNM SWITCH SETTINGS

See Figure 13-2 for Alignment Points Diagram.

Command and Control Communication

The command and control communication is by blank and burst signaling using Audio Frequency Shift Keyed data on the Main audio lines.

13.2.2 AFSK COMMUNICATION ON THE MAIN LINES

Table 13-1 SNM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
AFSK Communication On The Main Line.								
S1	1	-	-	4	-	2	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

13.2.3 SNM JUMPER PLACEMENT

Table 13-2 SNM JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2*	Selects 27512 EPROM operation
	2 to 3	Selects 27256 EPROM operation
J27	1 to 2	Not used
	2 to 3*	Normal operation
P33	1 to 2	Jumpered
	3 to 4	Jumpered
	5 and 6	open
J36	1 only	Not used
	1 to 2	-48V E-lead operation
	2 to 3	-15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Indicates normal operation.		

13.2.4 SNM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

Table 13-3 SNM EXTERNAL CONNECTIONS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	RxS+
pin 28	Sec Rx -	pin 2	RxS-
pin 29	EA lead	pin 3	EA
pin 30	EB lead	pin 4	EB
pin 31	Pri Rx Audio+	pin 5	RxA+
pin 32	Pri Rx Audio-	pin 6	RxA-
		J2,4,6,8	
pin 59	Sec Tx +	TxS+	pin 1
pin 60	Sec Tx -	TxS-	pin 2
pin 61	MA lead	MA	pin 3
pin 62	MB lead	MB	pin 4
pin 63	Pri Tx Audio+	TxA+	pin 5
pin 64	Pri Tx Audio-	TxA-	pin 6

13.3 SNM ALIGNMENT SPECIFICATIONS

13.3.1 PRE-ALIGNMENT

The SNM is pre-aligned with the Basic Board Module alignment procedures; refer to Section 7.3.

13.3.2 SNM ALIGNMENT PROCEDURE

Connections to the SNM may take several forms:

1. Direct Connection
2. Leased Lines
3. Microwave Link
4. T1 Channel Bank Interfaces

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

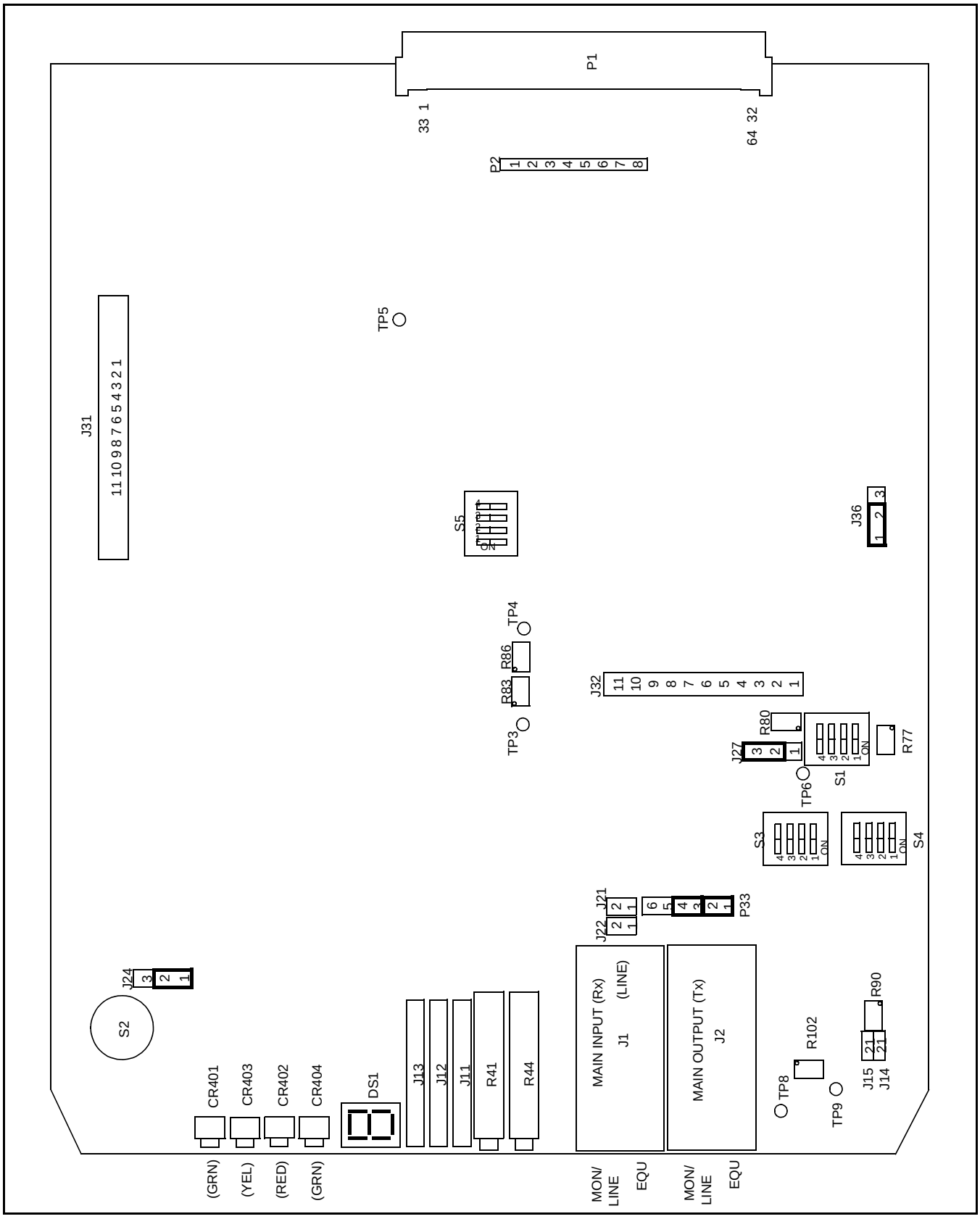


Figure 13-2 ALIGNMENT POINTS DIAGRAM

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.
2. Set S5 for Test 1 (open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.
5. Set S5 for Test 8 (open section 4, close 1, 2 and 3).
6. Reset the module, Press S2 and release.
7. Adjust R86 to be -12 dBm ±0.5 dB at TP4.
8. Verify the level at J12 to be -21 dB ±1 dB from the maximum level from Step 1.
9. Select for normal operation (S5 all sections closed).
10. Reset the module, Press S2 and release.

    Example: Microwave has -16 dBm max input, set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.
2. Set S5 for Test 1 (open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Insert the maximum level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.
5. Adjust R41 to be -6 dBm at J11.
6. Close section 2 of S1.
7. Adjust R102 to be 0 dBm at TP8.
8. Set S5 for normal operation (all sections closed).
9. Reset the module, Press S2 and release.

    Example: Microwave has +7 dBm maximum output, set J11 for -5 dBm.

Secondary Transmit and Receive

Not used since the secondary line is not used.

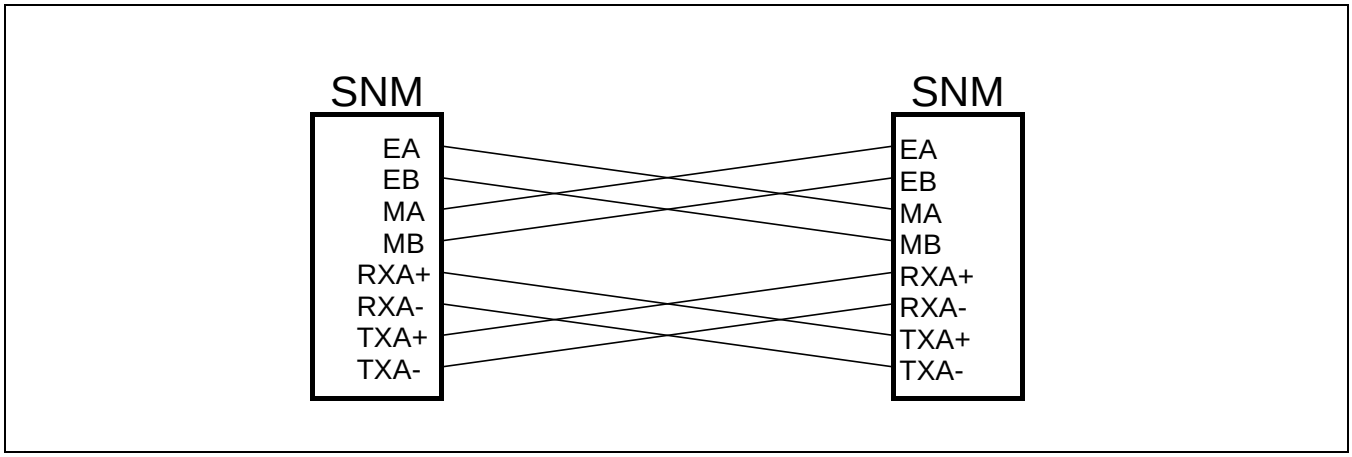


Figure 13-3 SNM CABLE LAYOUT

NOTE: This cabling is used within a single Switch or between Switches to allow Unique ID calls to occur.

SECTION 14 TELEPHONE INTERFACE MODULE (TIM)

14.1 DESCRIPTION

The Telephone Interface Module (TIM) connects the Switch to the telephone lines and handles telephone line protocols. The TIM may be referred to as a Trunk Interface Module. Refer to page 31 for FCC regulations.

The TIM logic unit is microprocessor controlled and communicates to the Call Processor via the intra-terminal data communication bus. A Switch may have multiple TIMs with varying styles of telephone lines attached. The telephone line audio is processed to interface with the Pulse Code Modulation (PCM) voice path.

The basic TIM operation functions are as follows:

1. Supervision
2. Signaling
3. Call Supervision
4. Intra-Terminal Communication

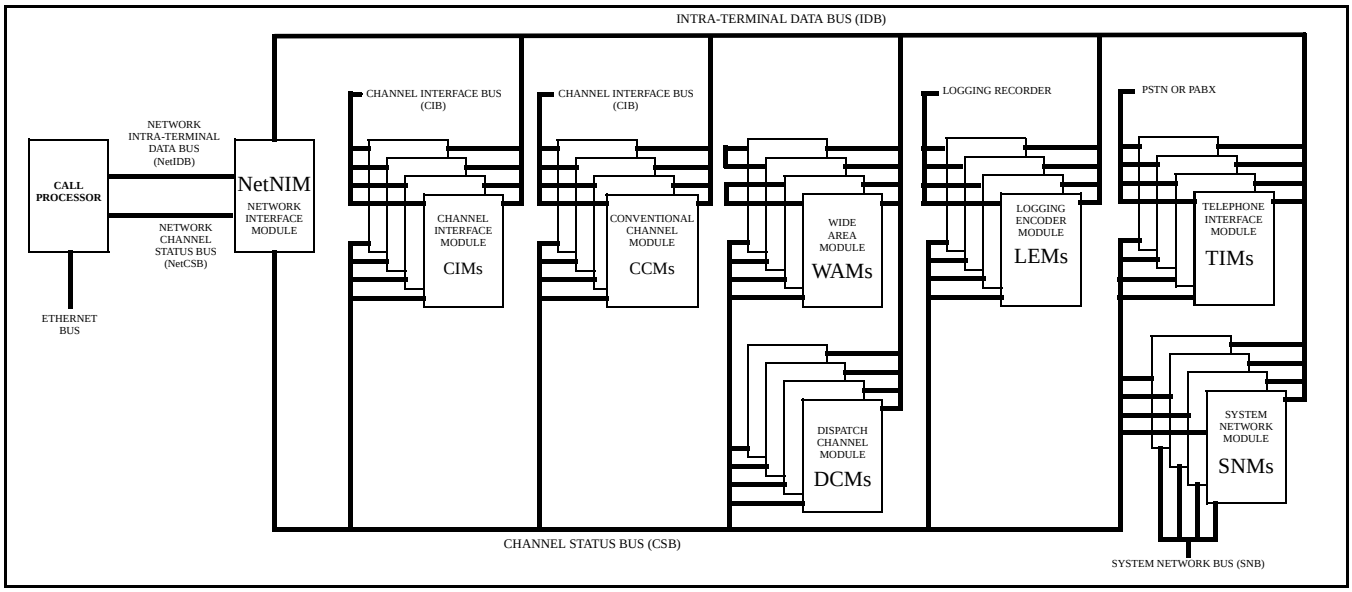


Figure 14-1 DATA BUSES

14.1.1 SUPERVISION

The TIM can be seized from either landside or internal. Landside seizure occurs by Direct Inward Dial (DID) or Two-Way Start (2WY). Internal seizure comes from the Intra-Terminal Data Bus (IDB) as a request for outgoing service on the telephone line (see Figure 14-15).

Once seizure has occurred, connection supervision takes place. Incoming calls are connected by Immediate Start or Wink Start. Immediate Start requires the ability to accept digits in less than 70 milliseconds before digits are sent. Wink Start sends digits after a short battery reversal and back to normal Battery before digits are received. Two-Way Incoming indicates readiness to accept "end-to-end" DTMF digits by outputting a "proceed" tone.

Outgoing calls have three ways to determine when to send digits:

1. Immediate Start

   Waits 70 milliseconds before digits are sent.

2. Dial Tone Delay

   Waits until 100 milliseconds of dial tone is received before digits are sent

3. Wink Delay

   Waits for battery reversal and back to normal battery before digits are sent.

14.1.2 SIGNALING

Once connection supervision has occurred, the digit signaling is done. There are two ways to send and receive digits:

1. Dial Pulse

   Counts the "breaks and makes" of loop current.

2. DTMF

   Determines the tone pair of a set of frequencies.

The TIM sends or receives the appropriate signaling depending on the direction of the call. The TIM is capable of sending and receiving "end-to- end" signaling where the call is completed and normal voice communication takes place, or numeric information can be sent or received via DTMF. Dial pulse information cannot pass through the telephone company's Central Office (CO) to make it back and forth to the units.

14.1.3 CALL SUPERVISION

Once the signaling of the digits has occurred, call status is determined for answer and disconnect.

Answer supervision is an indication of when the called party answers the telephone. The preferred method is by reverse battery answer, where the CO reverses the battery connection, therefore, current flow reverses when the called party answers. The other method is mobile speech activity that detects the presence of mobile speech for a certain length of time. If the telephone line cannot recognize reverse battery answer, none is sent toward the CO, and no real answer supervision exits. However, the mobile speech activity can be used for answer detection.

Disconnect supervision detects when the called party hangs-up (disconnects) and a message is sent to the TIM to disconnect from the telephone line. The preferred method is from reverse battery answer, where the battery returns to normal when the called party disconnects. The next method is to wait for the mobile disconnect message. If the mobile does not hang up properly, the message is not sent and the call continues. Fail-safe alternatives watch for loss of mobile speech or detect the return of dial tone. This ensures call disconnect allowing another call to be placed. The TIM then informs the Call Processor that it has disconnected from the telephone line.

14.1.4 INTRA-TERMINAL COMMUNICATION

The TIM communicates to the Call Processor through the Intra-Terminal Data Bus (IDB) and sends activity information to the Call Processor. The Call Processor sends messages to the TIM to request service, informs the TIM to disconnect, and any other necessary control information.

14.1.5 TELEPHONE LINE STYLES

There are several different styles of telephone lines the TIM controls. The following styles of lines and their basic connection are supported.

1. Direct Inward Dialing (DID)

   The DID offers direct inward dialing of the telephone number and supplies the -48V DC battery voltage to the incoming lines. The Central Office (CO) contacts the DID by closing the loop and sends the number to the DID by dial pulse or DTMF. The DID can handle 2, 3 or 4 digits being spilled forward by the CO.

2. 4-Wire E&M

   4-Wire E&M is primarily used with electronic switches, public leased lines or microwave equipment to provide complete separation of transmit and receive audio lines. The signaling unit provides the -48V DC battery to the M-Lead, while the trunk unit provides ground to the M-Lead. The signaling is reversed for the E-Lead (see Section 14.2).

3. Dial Pulse

   Dial pulsing is the "break and make" of the loop path current to cause no flow and flow. The number of breaks, when no current flows, is the number of the desired digit, with 10 pulses equaling 0.

4. Dual Tone Multi-Frequency (DTMF)

   DTMF tone signaling is used on almost all push button telephones. DTMF is where the desired digit is composed of a combination of two tones. A tone pair consists of one tone from the low band group (697, 770, 852 or 941 Hz), and the high band group (1209, 1336, 1447 or 1633 Hz).

14.1.6 AUDIO PROCESSING

The audio processing converts intra-terminal voice path audio to be placed on the telephone lines. The telephone line interface contains a hybrid that transmits and receives audio from the telephone line and keeps the transmitted audio out of the received audio to eliminate sidetone and echoing. The hybrid also converts the balanced telephone line to unbalanced connections.

14.1.7 RECEIVE AUDIO

The receive audio is from the telephone line and processed for the intra-terminal Pulse Code Modulation (PCM) channel stream (see Figure 14-14). The received audio has three paths:

1. Voice Audio

   The receive audio from the telephone line comes from the unbalanced receive side of the hybrid. The audio is level adjusted through an amplifier to give a correct line level adjustment and passes through minimal filtering to eliminate the possibility of unwanted frequencies. A transmission gate turns the audio on and off toward the terminal. The gate is followed by a level adjustment amplifier/buffer before the audio enters the intra-terminal voice processing. The intra-terminal voice processing is a PCM CODEC with a time slot determination circuit. The CODEC digitizes the analog voice and outputs it onto the PCM transmit channel stream in the appropriate time slot. The master clock and master frame sync are inputs to the TIM. These inputs provide timing for the CODEC and timing determination circuit.

2. Dial Tone Detection

   The receive audio from the telephone line is taken from the line level adjust amplifier buffer and passes into a bandpass filter centered on the frequencies used for dial tone. The bandpass filter is adjusted for detection of the dial tone sent by the CO. The output of the bandpass filter passes to a rectification and detection circuit. The output of the detection circuit indicates the presence of dial tone to the logic unit.

3. DTMF Detection

   The receive audio from the telephone line is taken from the line level adjust amplifier buffer. The audio passes into the DTMF detection circuitry and outputs the tone pair received and the valid tone pair signal to the logic unit.

14.1.8 TRANSMIT AUDIO

The transmit audio from the PCM channel stream is processed to analog and sent to the telephone line (see Figure 14-14). The functional paths of the transmit audio are:

1. Voice Path

   The transmit voice is processed from the PCM channel stream by the same CODEC and time slot determination circuitry as in the receive audio voice path section above. The digitized voice is converted to analog and filtered by the CODEC to a high pass filter to eliminate low frequency audio. The audio is level adjusted by an amplifier buffer and gated into a summing amplifier buffer. The audio gating provides on/off control of the voice audio to the telephone line. The summing buffer has a level adjustment to set the outgoing line level and drives the unbalanced side of the telephone line hybrid.

2. Mobile Speech Detection

   The audio for mobile speech detection comes from the CODEC amplifier buffer. The bandpass filter is centered at the audio frequency recognized for voice peaks. The filtered audio is rectified and detected for the presence of voice. The output of the detector is an input to the logic unit.

3. DTMF Generation

   The DTMF signaling is generated on the TIM and transmitted toward the telephone line. The logic unit provides the inputs to the DTMF generation circuit. The generator outputs the desired tones and is adjusted to the proper level with respect to the voice path by an amplifier. The tones pass through a logic unit controlled audio transmission gate, summing amplifier buffer, to the telephone line.

14.2 4-WIRE E&M INTERFACE DESCRIPTION

The 4-Wire E&M Interface Card connects the Switch with a 4-Wire audio circuit that supports Ear and Mouth (E&M) signaling.

14.2.1 AUDIO

The audio circuit consists of a transmit (Tx) pair and a receive (Rx) pair. The Tx pair transmits audio and DTMF digits. The Rx pair receives audio and DTMF digits. Dial Tone detection is also supported by the Rx pair.

14.2.2 E&M LEADS

The E&M leads can be configured for Type I, II, III, IV and V signaling by changing S201 on the personality card (see Figure 14-21).

The E-Lead is a single input that monitors for -48V, or ground. This lead is used to detect inbound ringing (detected as battery reversals), receive pulse dialed digits (detected as battery reversals), wink start pulse (detected as a single battery reversal), and an answer or hang-up by the connected circuit (detected as a lead reversal). This lead can be set up for -48V or ground idle states by changing S201, section 7 and 8.

The M-Lead is a single output that signals to the connected circuit with -48V, or ground. This lead is used to request service (battery reversal), send a wink start pulse (battery reversal), signal a hang-up or answer to the circuit (battery reversal), transmit pulse dial digits (sent as battery reversals). The state of this lead is configured by S201, section 1 through 6.

NOTE: If this card is connected to a 2-Wire circuit, a Termset is required. This card supports pulse dialing for both inbound and outbound. Pulse dialing is described as full battery reversal, not click detection from the Central Office (CO). If click detection is required, an external device is needed to support this feature.

The E&M Interface Card installation instructions are not for a specific installation because of the many unique configurations. The field engineer customizes or alters the installation for the appropriate interface requirements.

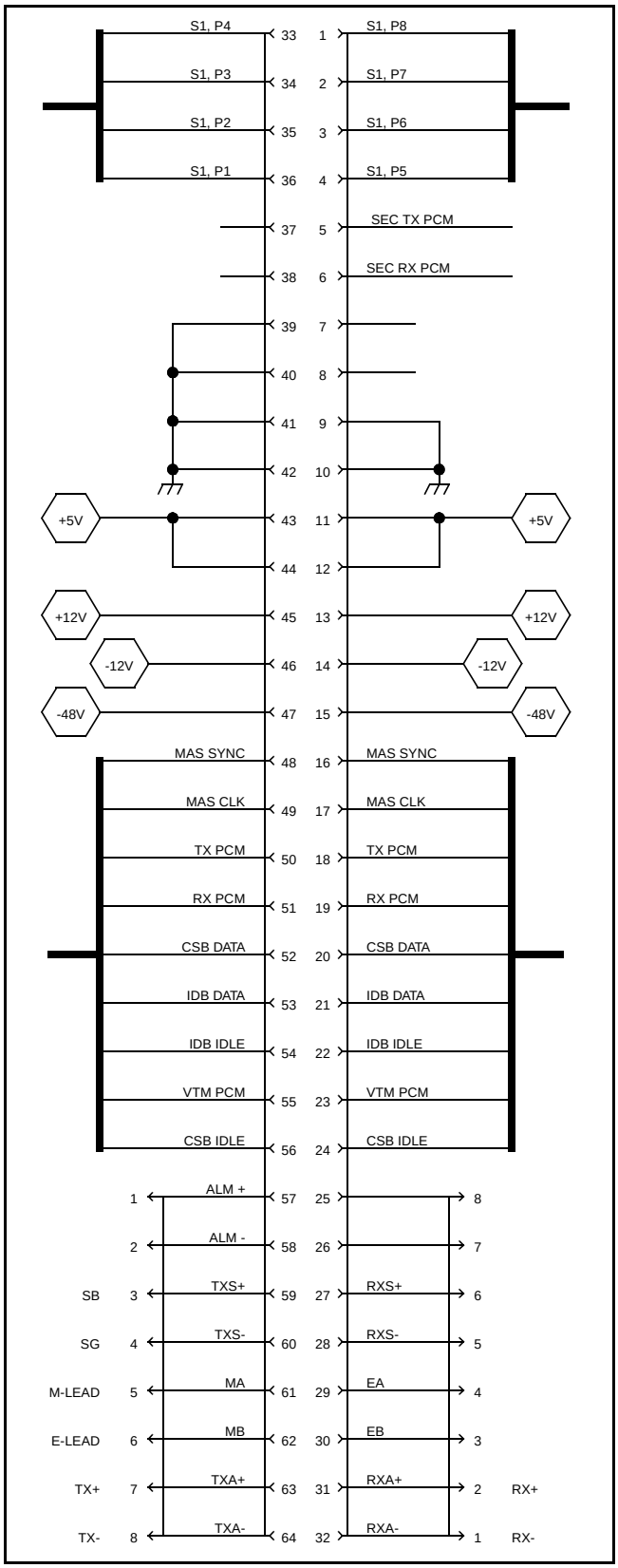


Figure 14-2 E&M INTERFACE CONNECTIONS .

14.2.3 8-POSITION DIP SWITCH S201

The 8-position DIP switch S201 determines the interface type. There are five types of E&M interface signaling, Type I through Type V.

C A U T I O N

Do not adjust S201 with the E&M card connected in any way to the Switch. Damage to the E&M card could result.

Refer to Table 14-1 for S201 configurations for each type of signaling.

NOTE: S201 positions 7 and 8 are for E-Lead detection type.

Table 14-1 E&M CARD S201 DIP SWITCH SETTINGS

Type	Position							
	1	2	3	4	5	6	7	8
I	On	Off	On	On	On	Off	Off	On
II	Off	On	Off	On	Off	Off	Off	On
III	Off	On	On	On	On	Off	Off	On
IV	Off	On	Off	On	Off	Off	Off	On
V	Off	Off	On	Off	Off	On	Off	On

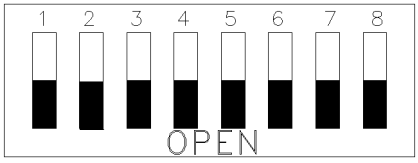


Figure 14-3 S201

NOTE: Black is switch position

Table 14-2 E&M LEAD STATES

M-Lead States for Type I through V		
Type	**Idle**	**Active**
I	Ground	-48V
II	Open	-48V
III	Ground	-48V
IV	Open	-48V
V	Open	Ground
E-Lead State for all Types		
7 (Off), 8 (On)	Open	Ground
7 (On), 8 (Off)	Ground	Open

14.2.4 TYPE I AND V

A straight interconnect between the trunk circuit and signaling circuit. Two conductors are signaling and four are balanced audio (see Figure 14-4).

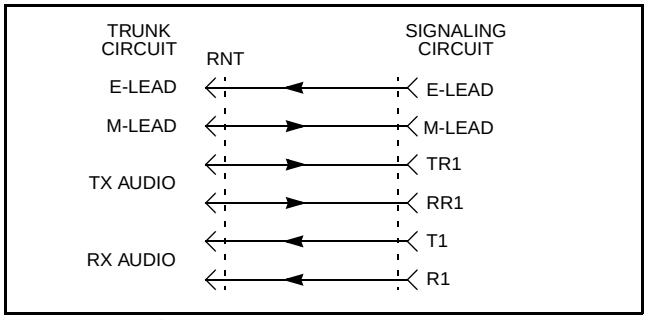


Figure 14-4 TYPE I AND V

14.2.5 TYPE II AND III

A straight interconnect between the trunk circuit and signaling circuit. Two conductors are signaling, four are balanced audio and two are System Battery and System Ground (see Figure 14-5).

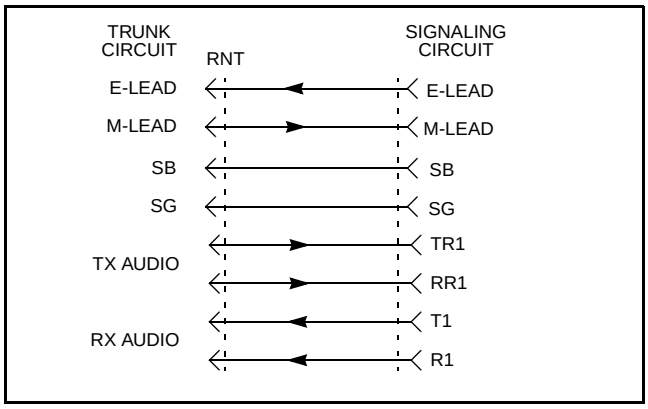


Figure 14-5 TYPE II AND III

14.2.6 TYPE IV

This interface is a cross-connect between the trunk circuit and signaling circuit. Two conductors are signaling, four are balanced audio and two are System Battery and System Ground. This type of interface has the M-Lead and System Battery cross-connected (see Figure 14-6).

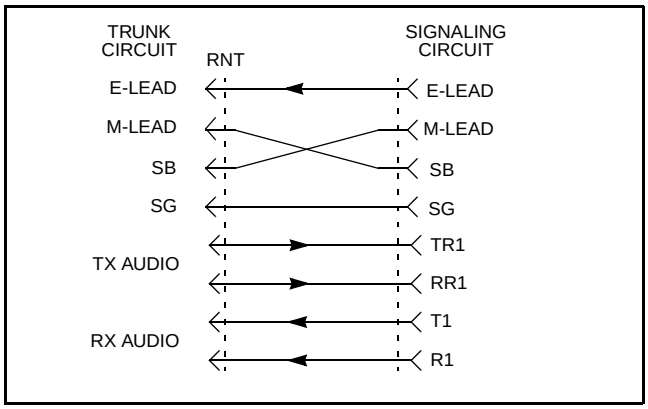


Figure 14-6 TYPE IV

14.2.7 TYPE II TRUNK-TO-TRUNK

Some applications may require an interface to another trunk circuit (e.g. PBX). This interface is a cross-connect between trunk circuits. Two conductors are signaling, four are balanced audio and two are System Battery (SB) and System Ground (SG). The System Battery and System Ground are cross-connected with the E-Lead and M-Lead (see 14-7Figure 14-6).

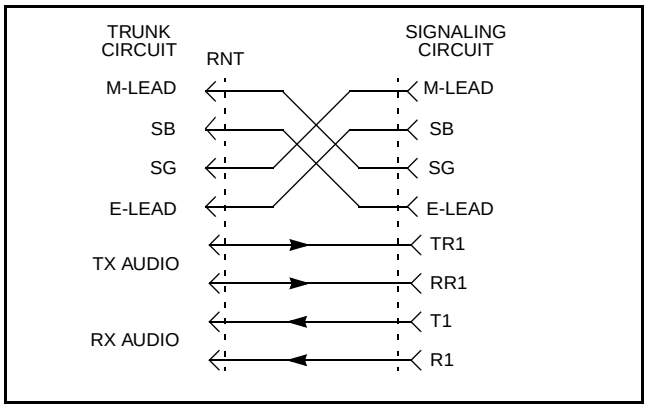


Figure 14-7 TYPE II TRUNK-TRUNK

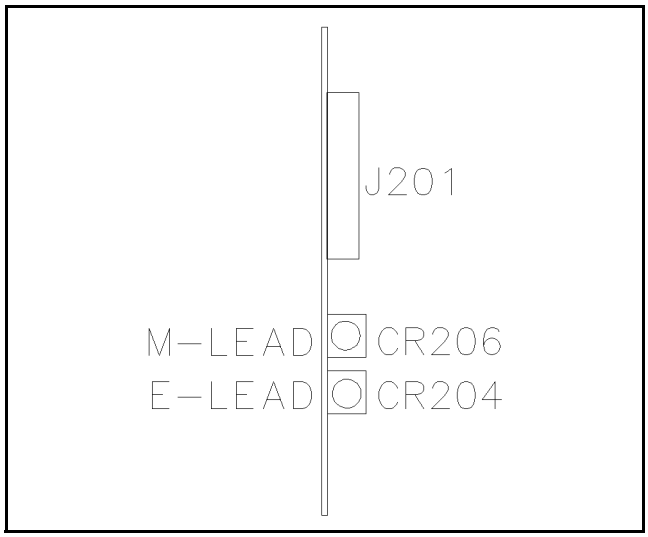


Figure 14-9 E&M PERSONALITY BOARD

14.2.8 TYPE V TRUNK-TO-TRUNK

This interface is a cross-connect between the trunk circuits. Four conductors are balanced audio and the M-Lead and E-Lead conductors are cross-connected (see Figure 14-8).

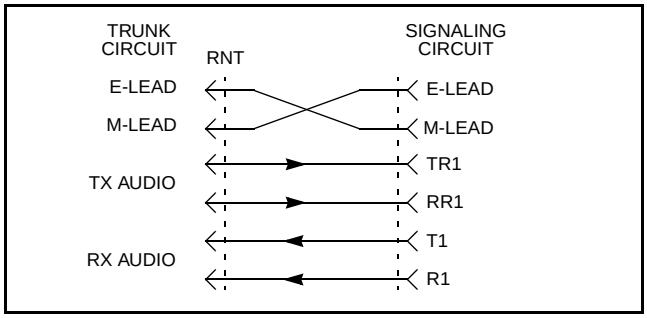


Figure 14-8 TYPE IV TRUNK-TRUNK

14.3 LED STATUS FOR E&M LEADS

14.3.1 TELCO SIDE STATUS

The Telco Side Status can be monitored on CR206 (M-Lead) and CR204 (E-Lead) see Figures 14-9 and 14-21. These LEDs are used to show a status change on the Telco side of the E&M Personality Board. In some instances either or both could be illuminated in the idle state.

14.3.2 E&M LOGIC STATUS

The status of E&M Logic can be monitored on CR401 (E-Lead) and CR403 (M-Lead) of the main board (see Figure 14-10). These are logic levels that display the true status of the E&M leads. If either LED is illuminated, that lead is active. Both LEDs should not illuminate in the idle state.

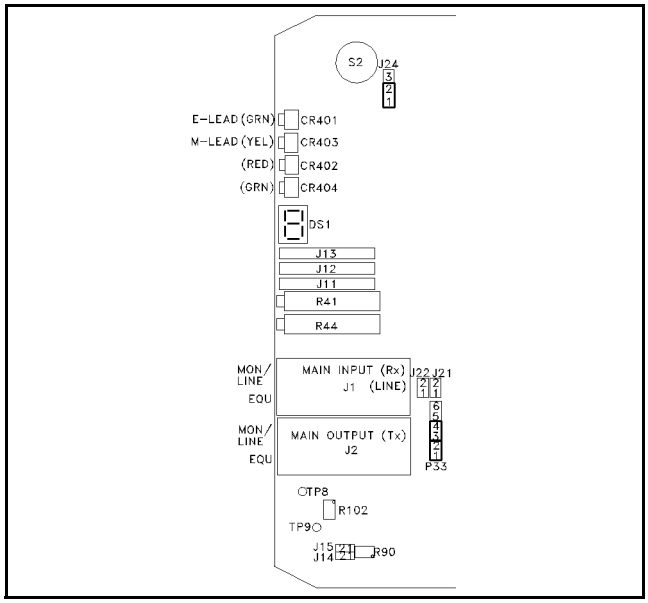


Figure 14-10 MAIN BOARD

14.4 E&M LEAD CIRCUIT THEORY OF OPERATION

14.4.1 E&M INTERFACE

This card was designed to mate with any of the five available E&M signaling formats. E&M signaling usually requires a -48V supply with positive ground and must have some type of current limiting available. Q205 and Q204 are a bipolar constant current source used for current limiting.

CR201, CR202 and CR203 are 68V, 0.5W zener diodes that act with RV202-RV208 to provide electrostatic discharge protection. These devices ground any voltage spikes caused from back-EMF associated with driving relay type E&M systems.

The basic switching for this card comes from Q202/Q203 (a complementary Darlington pair). With S201 (8-position DIP switch) the relative configuration of Q202/Q203 can be manipulated. Figure 14-11 is an “equivalent switching” diagram for a TYPE III configuration.

The drive for Q202 and Q203 is from optoisolators U213/U214. Q206 is used only in Type V interface where an inversion is required to drive Q202.

The E-Lead current sensor consists of current limit resistor R219 and an optoisolator U212. CR205 is for reverse voltage protection for the optoisolator and LED CR204.

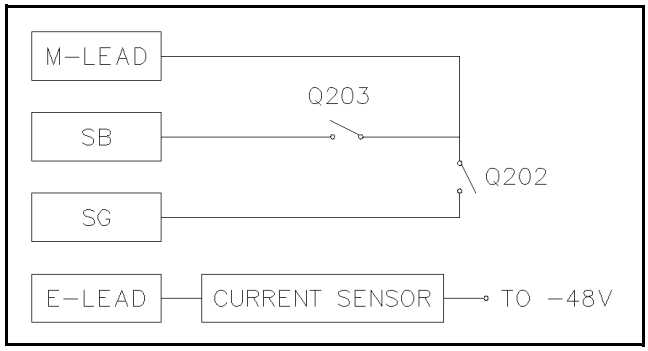


Figure 14-11 TYPE III INTERFACE

14.4.2 SIGNAL CONDITIONING

Q201 inverts the logic to the Schmitt buffer U211. The buffer output is used to charge and discharge C227 through R230 and the series output resistance of CMOS gate U211. When the buffer is on, C227 is charged through R230 which sets up an exponential ramp voltage on C227. R231/R232 set a reference of 2.17V and R233/R234 set a reference at 2.86V. As C227 is charging from 0 to +5V the comparator sequentially trips causing U213 to trip first and U214 to trip ~ 0.3 ms later (see Figure 14-12).

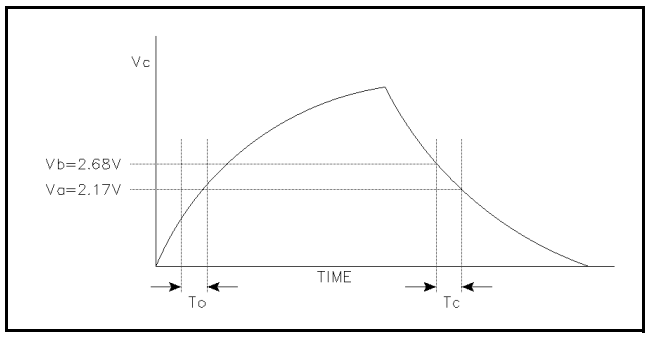


Figure 14-12 CHARGING CHARACTERISTIC OF C227

When a "0" is written to Q201 the reverse action occurs with the discharge of C227 through R230. The reason for this sequencing is to emulate a "break-before-make" switch. By sequencing the drive to the optoisolators U204 becomes an equivalent SPDT switch. When the output of the comparators goes low, they activate U213/U214.

The E-Lead output from U212 is debounced by dual retriggerable monostable multivibrator U210. It is configured as two one-shot multivibrators with RC time constants of 5 ms and 10 ms respectively. This circuit debounces transients in both E-Lead signal states (low or high).

The first one-shot multi vibrator is used to debounce a transient “1” during a logic “0”. The $\overline{Q}$ output of the first one-shot is NANDed with its input (R221/C226 are used to eliminate a possible race condition that may occur through the one-shot) in which the output of U211, pin 3 goes low only when the input pulse width exceeds 5 ms. This output is fed into U210, pin 12 which is being retriggered by the

oscillator of U211 running at ≈ 3.7 kHz. With U244, pin 12 low the output of U210, pin 9 is a “1” (U210, pin 12 is constantly being retriggered). If a transient “0” during a logic “1” is encountered at the E-Lead, U210, pin 7 is retriggered causing U211, pin 3 to go high for 5 ms. This will not change the output of U211, pin 9 because it is being retriggered. If U211, pin 3 stays high longer than 10 ms, U211, pin 9 goes low. For this to occur, the transient would need to exceed 10 ms.

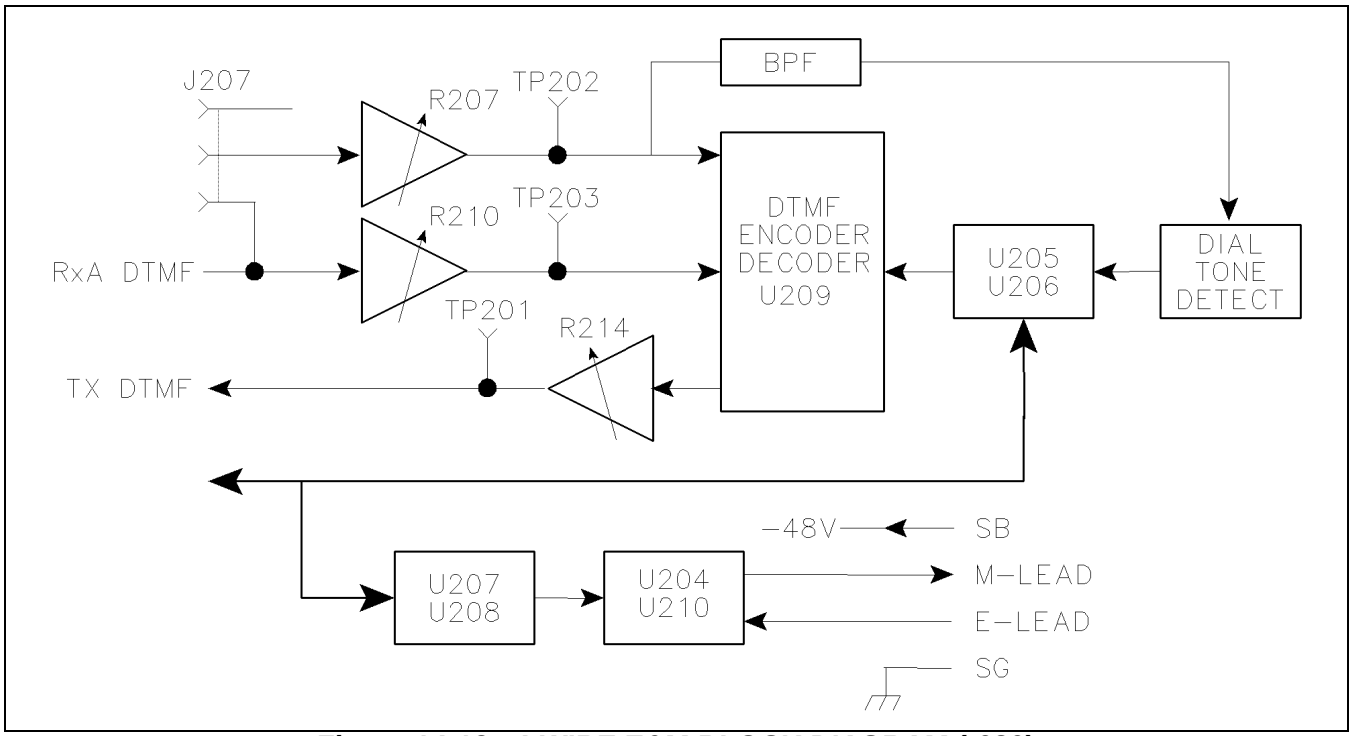


Figure 14-13 4-WIRE E&M BLOCK DIAGRAM (-680)

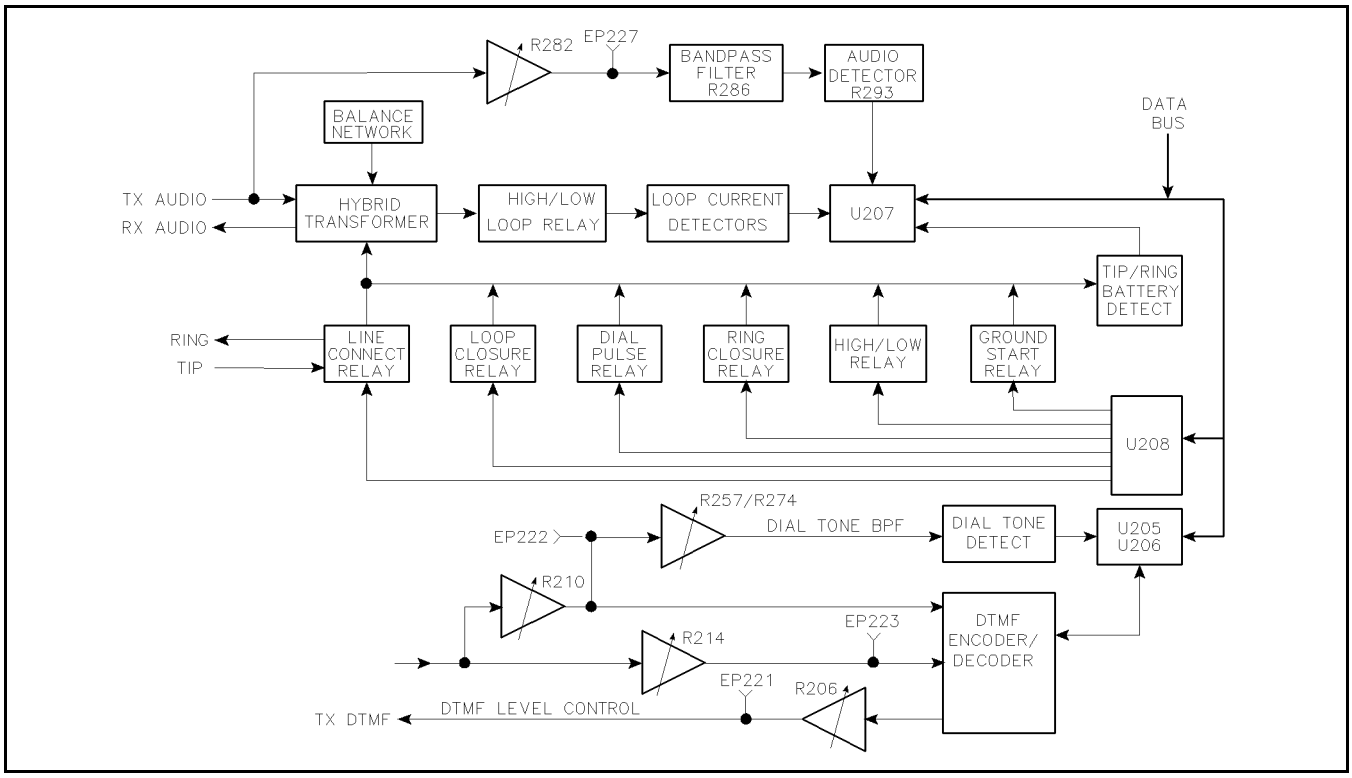


Figure 14-14 DT & MBS PERSONALITY CARD BLOCK DIAGRAM (-670)

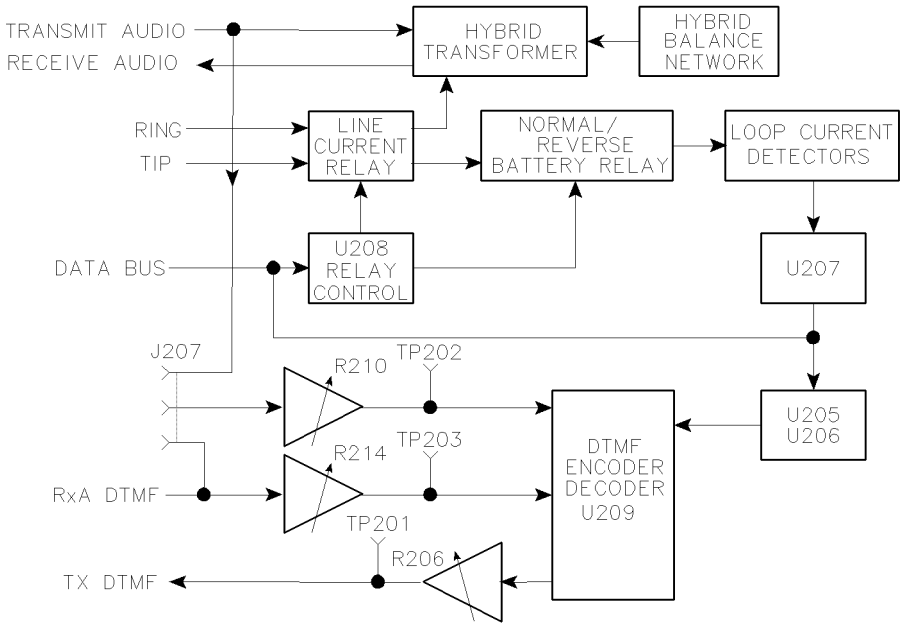


Figure 14-15 DID PERSONALITY CARD BLOCK DIAGRAM (-660)

14.5 TIM SETUP PROCEDURE

There are two personality cards that may be setup and aligned: (See Figures 14-19, 14-20 and 14-21.)

1. 2WY (new style) Section 14.6.
   Part No. 023-3039-670
   Reg. # ATHUSA-61094-MF-E

2. DID Section 14.8.
   Part No. 023-3039-660
   Reg. # ATHUSA-61904-MF-E

3. 4-Wire E&M Section 14.10
   Part No. 023-3039-680

14.5.1 TIM JUMPER PLACEMENT

Table 14-3 TIM JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not used Normal operation
P33	1 to 2 3 to 4 5and 6	open open open
J36	1 only 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Indicates normal operation.		

14.5.2 MAIN BOARD SWITCH SETTINGS

The TIM does not use secondary signaling for Command and Control Communication (see Figure 14-18).

Table 14-4 TIM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	2	-	4	-	-	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

14.6 2WY SETUP AND ALIGNMENT PROCEDURES (-670)

2WY card (023-3039-670) is to be setup and aligned according to the following procedures. The 023-3039-670 has been approved with the following FCC number ATHUSA-61094-MF-E.

14.6.1 2WY JUMPER SETUP

Table 14-5 2WY JUMPER PLACEMENT

JU	Pin	Description	
J204	1 to 2 2 to 3 2 only*	Loop Impedance High impedance < 19k ohms Low impedance < 150 ohms Infinite impedance	
J205	1 only* 1 to 2	Line default disable mode - RING Open line Default to ground	
J206	1 only* 1 to 2	Line default disable mode - TIP Open line Default to ground	
J207 J208		Battery or Ground Detect - TIP	
	J207	J208	
	1 only	1 to 2	No detect
	1 to 2*	1 to 2*	-12V or less
	2 to 3	1 to 2	-7V or less
	1 to 2	2 to 3	Not Used
	2 to 3	2 to 3	-5V or more
J209	1 to 2 1 only*	Transmit Gain No gain +6 dB gain	
2WY Ground Start - Tip P1, pin 32, Ring P1, pin 31 * Indicates normal operation.			

14.6.2 2WY PRE-ALIGNMENT PROCEDURES

The Central Office (CO) typically provides a dial up Test Tone (TT) and a Silent Line (SL). A DDO or 2WY TIM can dial these numbers for alignment purposes when the modules are installed in a working system.

The TT from the CO is typically the maximum level the line will output or accept. The typical level is 0 dBm at the CO interface. The average level of speech on the line will typically be -13 to -16 dBm.

The TIM should be pre-aligned using the Basic Board Module alignment procedures, Section 14-18.

Input With Personality Card Installed

1. Jumper T201, pin 8 to T202, pin 12.
2. Insert 1004 Hz at -12 dBm with a 600 ohm driving impedance into the EQU of J1.
3. Set S5 for Test 7 (sections 1, 2 and 3 open, close 4).
4. Reset the module, Press S2 and release.
5. Adjust R41 for -6 dBm ±0.5 dB at J11.
6. Verify -6 dBm ±1 dB at TP5.
7. Adjust R214 on the personality card for -12 dBm ±1 dB at EP223 (DTMF input level).
8. Adjust R210 on the personality card for -12 dBm ±1 dB at EP222.
9. Set S5 for normal operation (all sections closed).
10. Reset the module, Press S2 and release.

Bandpass Filter and Pulse Detector

1. Jumper T201, pin 8 to T202, pin 12.
2. Insert 395 Hz at -12 dBm with a 600 ohm driving impedance into the EQU of J1. (The typical Dial Tone is 380 + 440 Hz, the 395 Hz simulates this Dial Tone.)
3. Set S5 for Test 7 (sections 1, 2 and 3 open, close 4).
4. Reset the module, Press S2 and release.
5. Verify -6 dBm ±0.5 dB at J11.
6. Verify -6 dBm ±1 dB at TP5.
7. Adjust R210 on the personality card for 0 dBm ±1 dB at EP222.
8. Adjust R257 for a peak level at U203, pin 7 (typically -1 dBm ±1 dB).
9. Set Detector
   a. Measure EP225 with an oscilloscope.
   b. Adjust R274 until EP225 is high (>4V).
   c. Adjust R274 until EP225 just goes low (< 0.8V).
   d. Verify that EP226 is a square wave of the input waveform.
5. Set S5 for normal operation (all sections closed).
6. Reset the module, Press S2 and release.

Output

1. Jumper T201, pin 8 to T202, pin 12.
2. Place a 600 ohm resistor in series with a non-polarized 2.2 µF capacitor in EQU J1.
3. Set S5 for Test 1 (1 open, close 2, 3 and 4).
4. Reset the module, Press S2 and release.
5. Adjust R83 for -3 dBm ±0.5 dB at TP3.
6. Adjust R44 to be -9 dBm ±1 dB at J12. (This provides a maximum level of -13 dBm ±2 dB across the line. The loss is due to the hybrid transformer. Verify the level across the 600 ohm resistor and 2.2 µF cap is -13 dBm ±2 dB, measure with a balanced non-grounded AC voltmeter.)
7. Mobile Speech Detection
   a. Set S5 for Test 7 (section 1, 2, 3; open, close 4).
   b. Reset the module, Press S2 and release.
   c. Insert 700 Hz into J2 EQU with a 600 ohm balanced ungrounded oscillator.
   d. Set oscillator for -15 dBm at J201, pin 5.
   e. Adjust R282 for -18 dBm ±1 dB at EP227.
   f. Adjust R286 (counterclockwise) for a peak at U220, pin 7, -19 dBm ±1 dB.

g. Adjust R293 until U204, pin 14 is high (> 4V).

h. Adjust R293 until U204, pin 14 just goes low (< 0.8V).

i. Remove 700 Hz.

10. DTMF Output Level

a. Jumper T201, pin 8 to T202, pin 12.

b. Set S5 for Test 3 (sections 1-2 open; close 3-4).

c. Reset the module, Press S2 and release.

d. Adjust R206 on the personality card for -12 dBm ±0.5 dB at EP221. Verify the level across the 600 ohm resistor and 2.2 µF cap is -16 dBm ±2 dB, measure with a balanced non-grounded AC voltmeter.

5. Set S5 for normal operation (all closed).

6. Reset the module, Press S2 and release.

14.7 2-WAY TIM ALIGNMENT PROCEDURES (-670)

Contact the Telephone Company and obtain the Test Tone and Silent telephone numbers. The levels provided by the telephone company may be at different levels than stated in this procedure. Typically, the Central Office (CO) provides a Test tone at 0 dBm which represents a Maximum Level. There is a possibility that the level provided is an Average Level (-12 dBm), the Voice Level can be above and below the Average Level. Some COs or PBXs use different Maximum Levels.

The alignment tone in the Switch is -12 dB relative to maximum audio level within the Switch. This procedure is used to set the transmit level at a level that is -12 dB relative to the maximum audio level of the telephone line. Dial Tone is typically provided at about 1 dB above Average Voice. Some adjustments may be necessary to or from the phone line to allow for acceptable audio levels.

NOTE: Determine the Maximum Level being used by the CO or the equipment being connected to for proper alignment.

14.7.1 MAIN RECEIVE

1. Put the card under test into the extension card.

2. Insert the lineman's set into the MON (top) jack of J1 and dial the Test Tone. Verify that Test Tone is heard.

3. Set S5 for Test 7 (sections 1, 2, 3 open, close 4).

4. Reset the module, Press S2 and release.

5. Remove the lineman's set.

6. Insert a Transmission Test Set in the MON jack of J1 and record the level. The level is ___ dBm. This is the line loss from the CO (assuming 0 dBm is being sent by the CO).

7. Record the level at J201, pins 1 and 3 (see Figure 14-19). The level is _____ dBm.

8. Connect the Transmission Test Set or AC voltmeter to J11, adjust R41 for 0 dBm.

9. Verify 0 dBm, ±1 dBm at TP5.

10. Adjust R214 on the personality card for 0 dBm, ±1 dB at EP223 (assuming the DTMF level was -10 to -13 dB).

11. Adjust R210 on the personality card for 0 dBm, ±1 dB at EP222.

14.7.2 DIAL TONE DETECTOR

1. Connect the meter to J11, momentarily remove the card from the slot and reinstall. This resets the card so the level and frequency of the dial tone can be measured.

2. Measure and record level and frequency at J11. The level is _____ dBm and frequency is _____Hz. The frequency should be recorded only if it is different than the standard 350-440 Hz dial tone.

3. Continue to measure at J11. Insert the generate portion of the Transmission Test Set into the EQU jack (bottom) of J1.

4. Set the Transmission Test Set to generate 395 Hz. If non-standard dial tone frequencies are used, use the frequency measured in Step 14.

5. Adjust the generator until J11 is the same level as measured in Step 14.

6. Monitor J11, decrease the output of the Transmission Test Set until the level at J11 is 10 dB below the level in Step 17.

7. Adjust R210 on the personality card for -6 dBm, ±1 dB at EP222.

8. Adjust R257 for a peak reading at U203, pin 7.

9. Connect an oscilloscope or DC voltmeter to EP225. Adjust R274 until EP225 is high, slowly adjust R274 until EP225 just goes low.

10. Remove the Test Set from EQU jack.

11. Set S5 for 0 and reset the card by pressing S2. A 2 should be displayed on the front 7-segment display.

14.7.3 OUTPUT HYBRID ADJUST

1. Insert the lineman's set into the MON jack of J1 and dial the Silent telephone number. If a silent number is unavailable, call a nearby phone where the mouthpiece can be removed or covered to obtain a quiet termination.

2. Set S5 for Test 1 (section 1 open, 2, 3, 4 closed).

3. Reset the module and remove the lineman's set.

4. Connect the Transmission Test Set to J12 and adjust R44 for a level -4 dB plus the level recorded in Section 14.7.1, Step 6. There is 8 dB loss through the hybrid.

   Example 1:

   Assume the CO maximum level is 0 dBm and that the Test Tone is sent at this level (0 dBm). Assume the level measured in Section 14.7.1, Step 6 is -7 dBm. This means there is 7 dB of line loss. The level at J12 should be set to 0 dBm as maximum level minus 12 dB for the Switch Alignment Tone relative to maximum level plus 8 dB for hybrid loss plus 7 dB for line loss for an Absolute Level of +3 dBm.

   J12 = 0 dBm-12 dB+8 dB+7 dB = +3 dBm

   Example 2:

   Assume a PBX maximum level is sent at a -10 dB relative level or an absolute level of -12 dB. Assume the level measured in Section 14.7.1, Step 6 is -15 dBm. This means there is 3 dB of line loss. The level at J12 should be set to -2 dBm as maximum level minus 12 dB for the Switch Alignment Tone relative to maximum level plus 8 dB for hybrid loss plus 3 dB for line loss for an Absolute Level of +3 dBm.

   J12 = -2 dBm-12 dB+8 dB+3 dB = -3 dBm

5. Adjust Hybrid Balance by monitoring J11 with the Transmission Test Set.

   a. Switch in/out S201-S202 and adjust R261-R262 for a minimum level.

   b. Switch S201-S202 in or out until little change or degradation is noted.

   c. Tune R261-R262 for minimum, then switch S201-S202 for minimum and again tune R261-R262 for minimum.

   d. This process should be repeated several times. The level should be -20 dB minimum (typically ≈ 30 dB) from the level recorded in Step 7.

5. Set S5 for Test 3, (sections 1, 2 open, 3, 4 closed).

6. Connect the Transmission Test Set to EP221 and adjust R206 for -12 dBm.

7. Set S5 for normal operation (all sections closed).

8. Remove the card from the extender card and insert the card back into the appropriate slot. The card displays a "2" in the 7-segment display.

9. To display digits dialed on the system, to or from the TIM and SNM on the Alarm Display, select the following:

F2 Manual Device Control/Setup
F4 User Setup
F6 Diagnostic Control
Y Displays digits in alarm display
Enter, Enter
Select F10 until the main menu is displayed
All digits, both in-bound and out-bound are displayed on the Alarm Display.

14.8 DID SETUP AND ALIGNMENT (-660)

14.8.1 DID PERSONALITY CARD JUMPER SETTINGS

Table 14-6 DID JUMPER PLACEMENT

JU	Pin	Description
J205		Line default disable mode - RING
	1 only*	Open line
	1 to 2	Default to ground
J206		Line default disable mode - TIP
	1 only*	Open line
	1 to 2	Default to ground
J207		Dial Tone or Mobile Speech Det.
	1 to 2	Dial Tone Detect
	2 to 3	Mobile Speech Detect
	1 only*	Not Used
J208		Fuse Holder
J209		Transmit Gain
	1 to 2	No Gain
	1 only*	+6 dB Gain
DID line connections - Tip, P1, pin 31 Ring, P1, pin 32 * Indicates normal operation.		

14.8.2 PRE-ALIGNMENT

The Central Office (CO) typically provides a dial up Test Tone (TT) and a Silent Line (SL). The DID alignment is more difficult since the line does not allow outward dialing, but the DID can still be aligned.

The TT from the CO is typically the maximum level the line will output or accept. The typical level is 0 dBm at the CO interface. The average level of speech on the line will typically be -13 to -16 dBm.

The TIM should be pre-aligned using the Basic Board Module alignment procedures, Section 7.3.

Input With Personality Card Installed

1. Insert 1004 Hz at -12 dBm with a 600 ohm driving impedance into the EQU of J1.

NOTE: Be sure to block the DC voltage provided by the DID by using a non-polarized 2.2 μF capacitor with a working voltage greater than 63V.

2. Set S5 for Test 7 (sections 1, 2 and 3 open, close 4).

3. Reset the module, Press S2 and release.

4. Adjust R41 for -6 dBm ±0.5 dB at J11.

5. Verify -6 dBm ±1 dB at TP5.

6. Adjust R214 on the personality card for -12 dBm ±1 dB at TP203 (DTMF input level).

7. Set S5 for normal operation (all sections closed).

8. Reset the module, Press S2 and release.

Output

1. Place a 600 ohm resistor in series with a non-polarized 2.2 μF capacitor, 63V breakdown or greater in EQU of J1.

2. Set S5 for Test 1 (section 1 open, close 2, 3 and 4).

3. Reset the module, Press S2 and release.

4. Adjust R83 for -3 dBm ±0.5 dB at TP3.

5. Adjust R44 to be -9 dBm ±1 dB at J12.
(This provides a maximum level of -13 dBm ±2 dB across the line. The loss is due to the hybrid transformer. Verify the level across the 600 ohm resistor and 2.2 μF cap is -13 dBm ±2 dB, measure with a balanced non-grounded AC voltmeter.)

   a. DTMF Output Level:

   b. Set S5 for Test 3 (sections 1-2 open; 3-4 closed).

   c. Reset the module, Press S2 and release.

d. Adjust R206 on the personality card for -12 dBm ±0.5 dB at EP221. Verify the level across the 600 ohm resistor and 2.2 µF cap is -16 dBm ±2 dB, measure with a balanced non-grounded AC voltmeter.

7. Set S5 for normal operation (all closed).

8. Reset the module, Press S2 and release.

14.9 DID OPERATIONAL ALIGNMENT PROCEDURES (-660)

The DID line cannot dial numbers towards the CO. This requires the card be pre-aligned and the levels from the CO are known. A known good working mobile or portable is required for the alignment of the DID line. Align the 2WY or DDO lines first to obtain the line loss from the CO.

Call a mobile or portable that is active in the system. Use a phone that can generate continuous DTMF. Answer with the mobile or portable.

Receive

1. Press the "5" key on the DTMF phone.

This level should be about -6 dB from the Test Tone on the transmitting phone. Verified by measuring the transmitting telephone using a high impedance ungrounded AC voltmeter across the line. Take note of this level relative to the CO Test Tone level. The level across the interface at the DID should be this level plus twice the line loss as measured when setting up a 2WY line.

2. Adjust R41 for the same relative level from +6 dBm at J11 as measured in Step 1.

3. Adjust R214 for the same relative level from +6 dBm at EP203 as measured in Step 1.

4. Release the "5" key.

Transmit (Revision 202 or Earlier.)

5. Inject 1004 Hz tone at the junction of C61 and R69 using a 0.1 µF cap in series with a 600 ohm oscillator. Adjust the oscillator level for a -3 dBm ±0.5 dB level at TP3.

6. Adjust R44 to add 8 dB, ±1 dB to the CO Test Tone level at J12. Verify that the level across the line is -12 dB, ±2 dB from the Test Tone level of the CO, use a balanced non-grounded AC voltmeter.

7. Verify the level at the telephone is clean and clear. Remove or cover the mouthpiece.

8. Adjust the Hybrid balance by switching capacitor using S201 and S202 and adjusting R261 and R262 for a minimum level at J11, the Rx test point. (This is an iterative process. The level should be -20 dB from the CO Test Tone at this level.)

9. Remove the tone and speak over the telephone and RF unit to ensure a clean and clear voice path.

NOTE: The mobile or portable must be keyed to transmit every 1 or 2 minutes for a brief period (1 or 2 seconds) to hold the connection.

Transmit (Revision 203 or Later)

1. Set S5 for Test 9 (1-4 open, 2-3 closed).

2. Reset the module. Press and release S2.

3. Call a number to the DID. The DID answers and places alignment tone on the line.

4. Adjust R83 for -3 dBm ±0.5 dB at TP3.

5. Adjust R44 to add 8 dB, ±1 dB to the CO Test Tone level at J12. Verify that the level across the line is -12 dB ±2 dB from the Test Tone level of the CO, use a balanced non-grounded AC voltmeter.

6. Verify that the level at the telephone is clean and clear. Remove or cover the mouthpiece.

7. Adjust the Hybrid balance by switching capacitor using S201 and S202 and adjusting R261 and R262 for a minimum level at J11, the Rx test point. (This is an iterative process. The level should be -20 dB from the CO Test Tone at this level.)

8. Set S5 to 0 (close all sections) and reset the card for normal operation.

14.10 E&M SETUP AND ALIGNMENT (-680)

The standard audio signal is defined as a 1 kHz audio tone modulated at 2 kHz deviation, with data modulated at 1 kHz deviation (total deviation is 3 kHz).

Table 14-7 E&M MAIN BOARD JUMPERS

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not used Normal operation
P33	1 to 2 3 to 4 5 and 6	open open open
J36	2 to 3	For E&M operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Indicates normal operation.		

Table 14-8 E&M JUMPER PLACEMENT

JU	Pin	Description
J207	1 to 2 2 to 3	Connects Dial Tone circuit Removes Dial Tone circuit
J209	1 to 2	Connects SG to Switch 0V (gnd)

14.10.1 EQUIPMENT REQUIRED

1. Digital storage scope (Tektronix 2430 or equivalent with roll mode trigger capability from 100 ms to 1 second).

2. Printer or plotter for scope (recommended for sending data back to E.F. Johnson for analysis).

3. Telephone test set (Ameritec V.F. test set model AM-44 or equivalent).

4. RF communications monitor.

5. Multi-Net Encoder/Decoder Box.

14.10.2 TRANSMIT ALIGNMENT

DTMF Transmit Level Adjust

1. Set S5 on the main board for Test 3 (sections 1 and 2 open, 3 and 4 closed).

2. Adjust R214 for -7 dB at TP201 (EP201). This sets the correct level of TX DTMF with respect to TX Audio.

NOTE: After adjusting this level, DTMF and audio are adjusted together by R44 (TX+/TX-). TX+ DTMF and audio are monitored at J12.

Transmit Audio Level Adjust

This procedure requires a fully tuned repeater for testing. Test this repeater by keying up in dispatch mode with a radio. Monitor the receive frequency and record the receive data level. Generate a DTMF 5 from the radio and record the total deviation of data + audio. Subtract the previous data level and record the audio level received.

Monitor the transmit frequency of the repeater. Key up the radio and record the transmit data level. Generate a DTMF 5 from the radio and record the total deviation of data + audio. Subtract the data level previously recorded and record the audio level received. This level of audio should be the same as the receive level. If not, retune the repeater before proceeding with this procedure.

Disable dial-tone detection in the Call Processor. With a known good repeater, attempt to make a call to a test phone over the 4-Wire circuit. If the call did not go through, check digit timing parameters (pulse and DTMF) or the level of DTMF transmitted at TX+/TX-. Normally this level is -7 dBm (346 mV RMS or 978 mV P-P). If the 4-Wire requires a different level adjust R44 while monitoring the transmit level for the appropriate level.

Once the call is connected to a test phone (a phone located at the site provided the call went through the CO or PBX), collect the repeater using the Multi-Net Encoder/Decoder box and communications monitor with a data level of 1 kHz. With the call still going, turn off the radio (do not pound '#' down the

call) and add in a 1 kHz tone at 2 kHz deviation (3 kHz deviation total). Adjust the E&M transmit level at TX+/TX- using R44 to the appropriate level (normally -7 dB).

NOTE: If the 4-Wire circuit requires a different level, adjust R44 to this level. If the circuit is a microwave link and is terminated into the CO or PBX with a 2-Wire to 4-Wire termset module, the output level of this device should be -7 dBm at TIP and RING (a 1 kHz tone modulated at 2 kHz should = -7 dB at Tip and Ring).

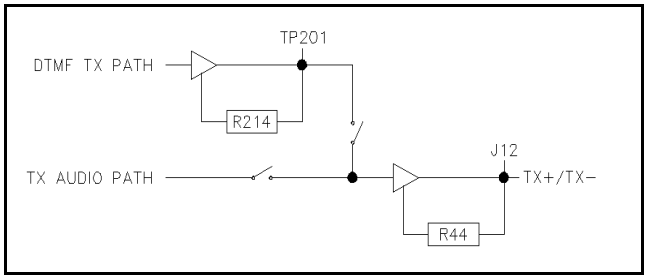


Figure 14-16 TRANSMIT DIAGRAM

14.10.3 RECEIVER ALIGNMENT

Receiver Audio Level Adjust

Tuning the receive path requires a 1 kHz tone at -7 dB be injected across Tip and Ring of the test phone (remote phone used in the transmit procedure). If the CO requires a level higher or lower for receive average audio, adjust to this level (-7 dB is accepted by 90% of COs).

Monitor the transmit frequency of the test repeater and adjust R41 until 3 kHz of audio deviation is transmitted (2 kHz audio + 1 kHz data = 3 kHz total deviation).

With the tone still injected at the remote phone monitor RX+/RX- at J11 and record the level of audio received. This value is used in the Receive DTMF procedure that follows.

Receive DTMF Level Adjust

Inject DTMF across RX+/RX- (J11) at the level recorded in the Receive Audio Level Adjust above. On the E&M personality board monitor TP203 and adjust R210 for -7 dB.

14.10.4 4-WIRE E&M DIAL TONE DETECTOR RECEIVE ALIGNMENT

1. Disable Dial Tone Detection at the Call Processor. Set the CO settle time to 750.

NOTE: This lengthens the time between going off-hook and dialing the first digit. Allow enough time to measure the level and frequency at J11 in Step 2.

2. With the telephone test set connected to J11 place a call. When dial tone is present measure and record the level and frequency at J11. The level is ____ dBm and the frequency is _____ Hz.

3. Continue to measure at J11. Insert the generate portion of the transmission test set into the EQU jack (bottom) of J1.

4. Set the transmission test set to generate the same frequency measured in Step 2.

5. Adjust the generator until J11 is the same level as measured in Step 2.

6. Monitor J11, decrease the output of the transmission test set until the level at J11 is 2 dB below the level in Step 2.

7. Adjust R207 on the personality card for -6 dBm, ±1 dB at TP202.

8. Adjust R247 for a peak AC voltage or dB level reading at TP204.

9. Connect an oscilloscope or DC voltmeter to TP206. Adjust R255 until TP206 is high, slowly adjust R255 until TP206 just goes low.

10. Remove the test set from EQU jack.

11. Re-enable dial tone detection in the Call Processor. Place a call to verify dial tone detection.

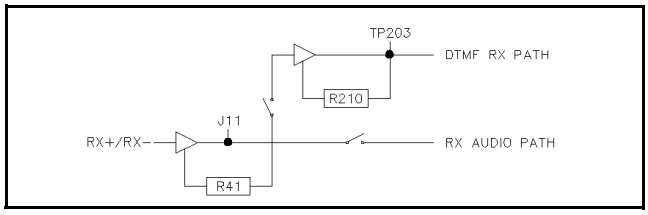


Figure 14-17 RECEIVE DIAGRAM

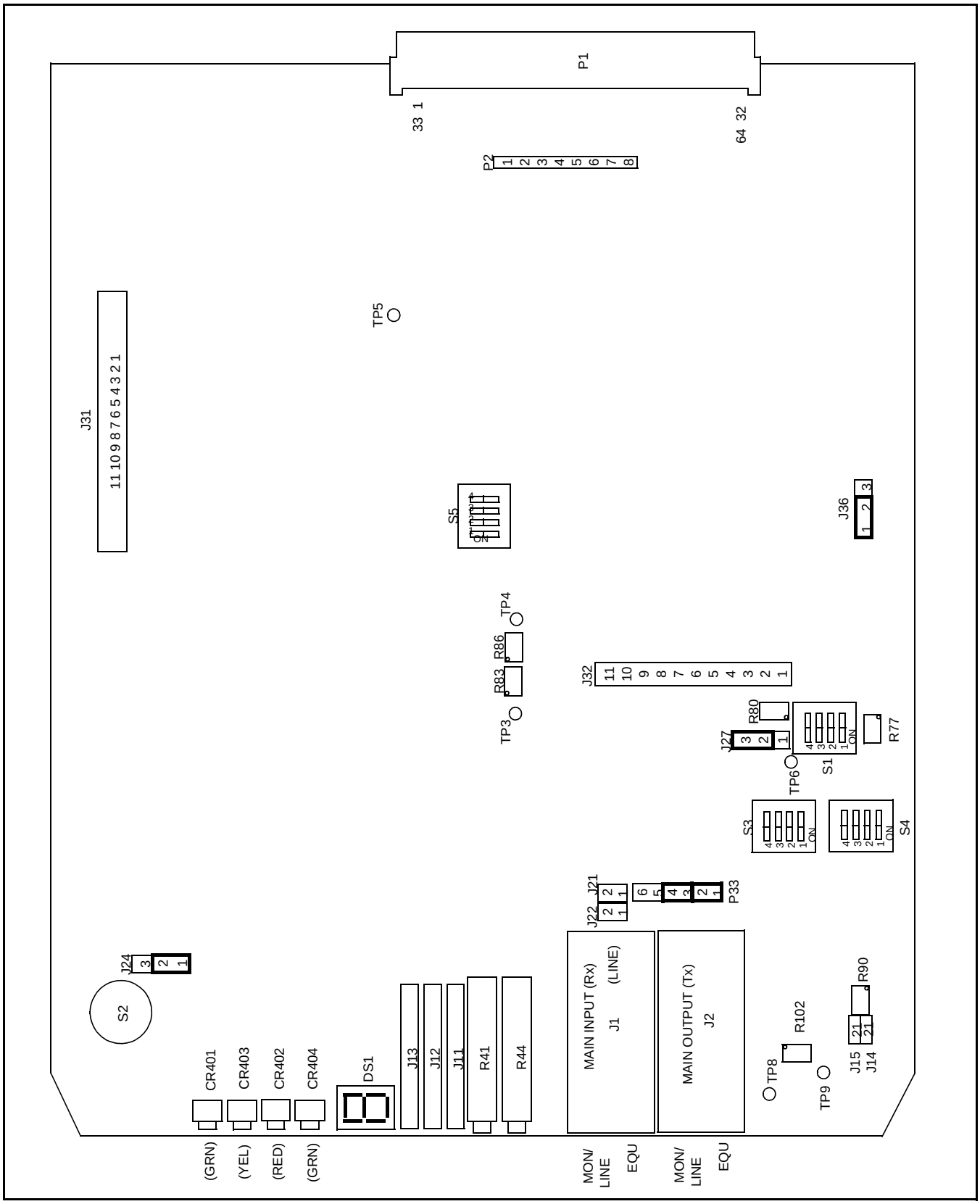


Figure 14-18 ALIGNMENT POINTS DIAGRAM

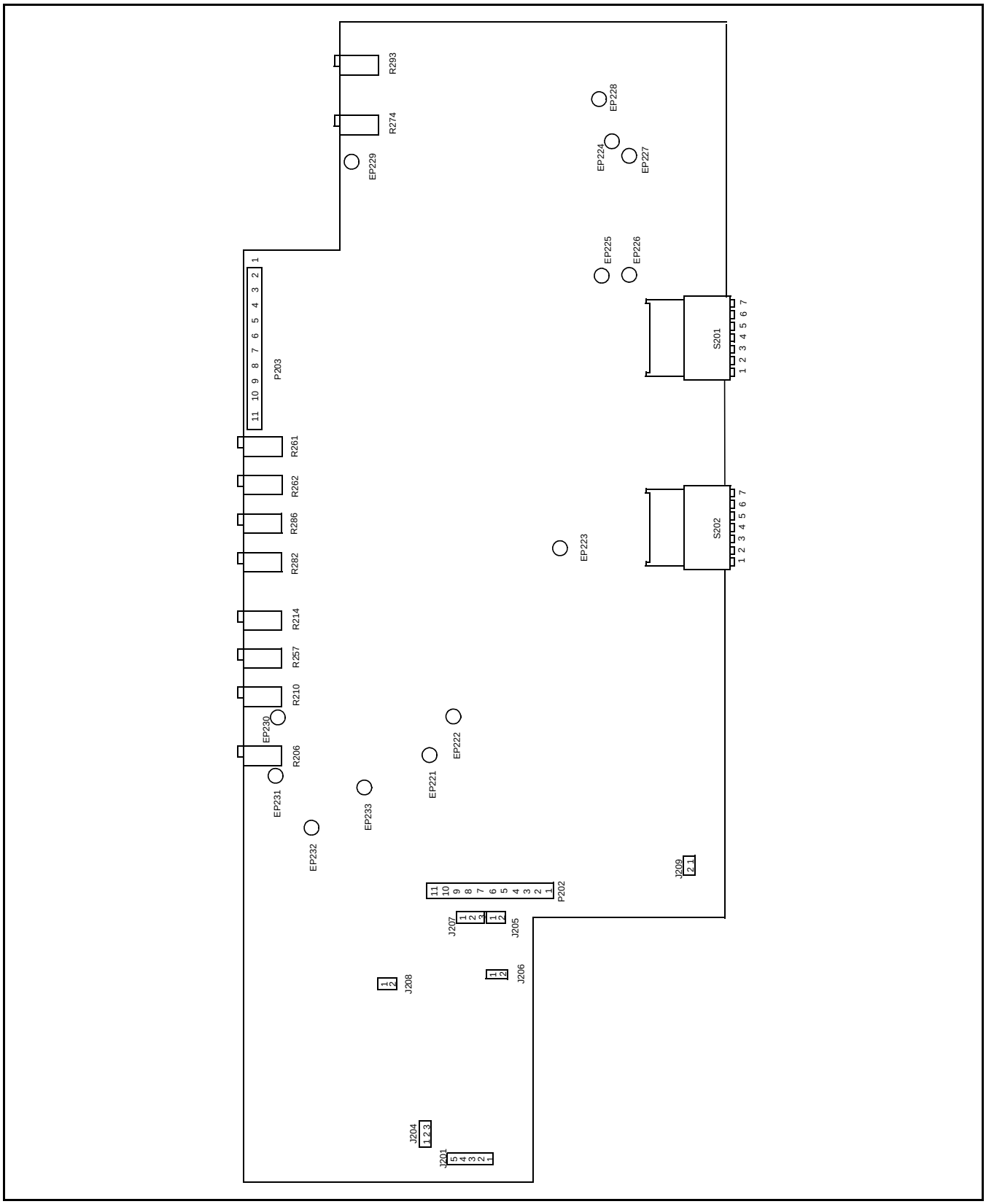


Figure 14-19 DT & MBS ALIGNMENT POINTS DIAGRAM (-670)

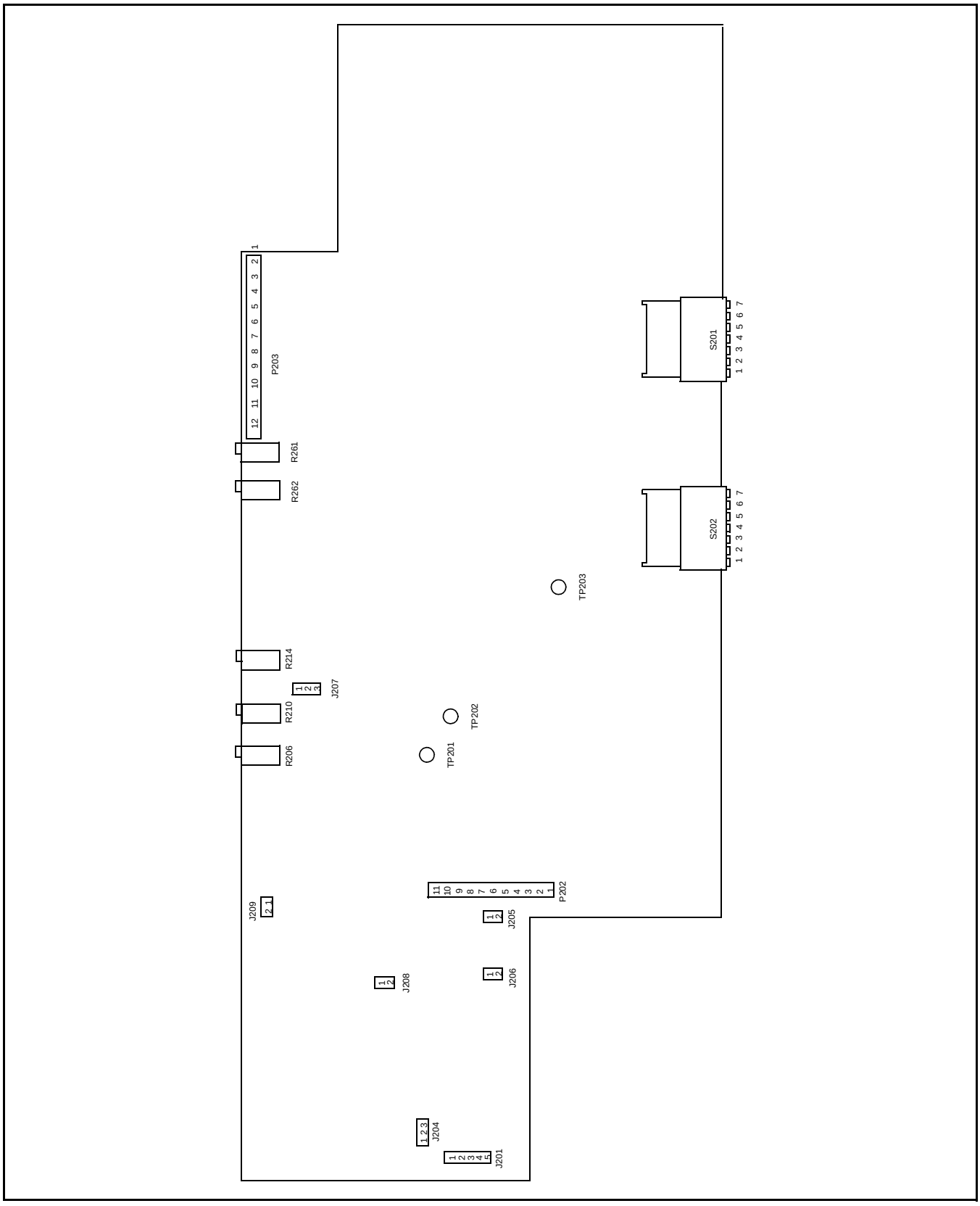


Figure 14-20 DID ALIGNMENT POINTS DIAGRAM (-660)

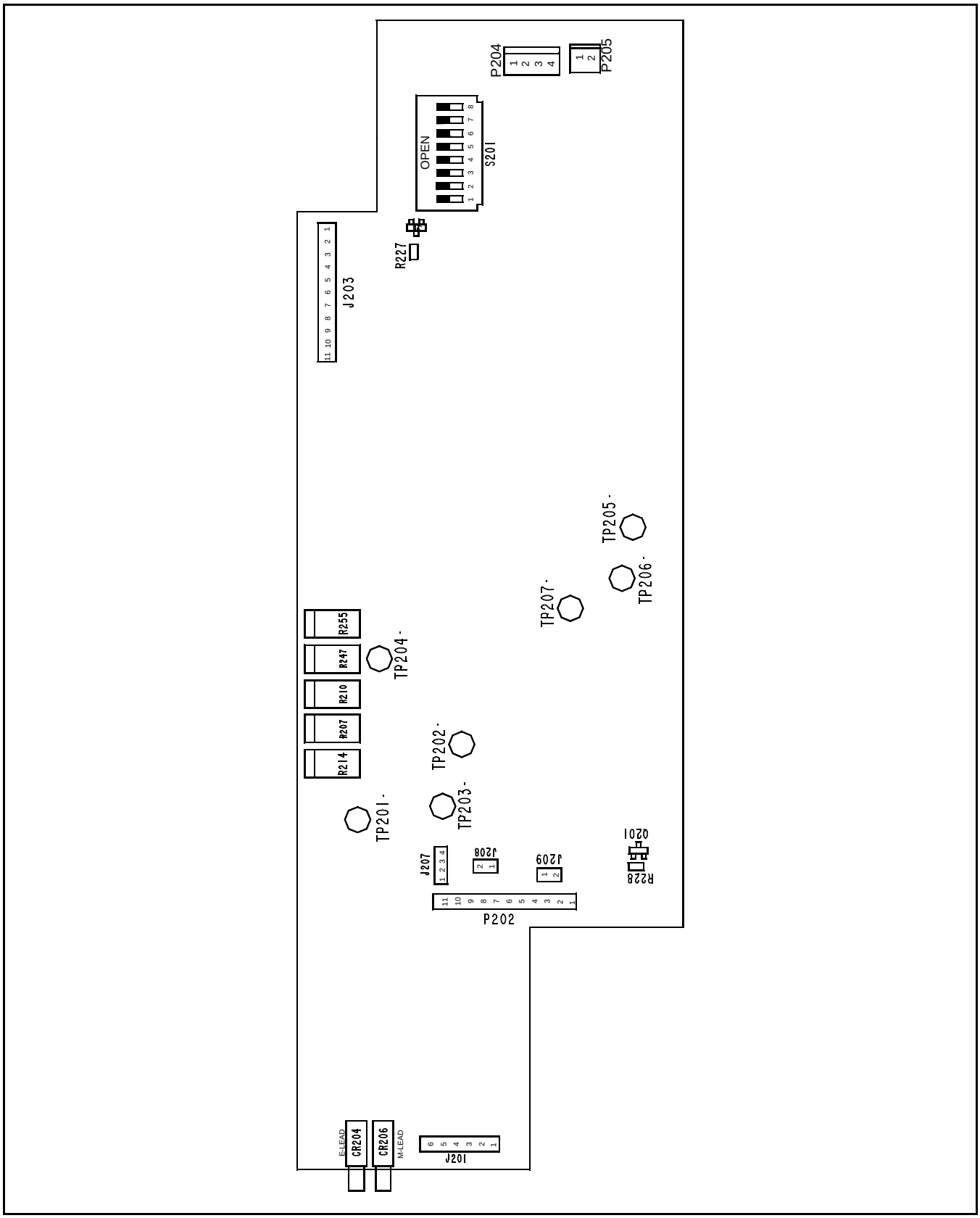


Figure 14-21 4-WIRE E&M ALIGNMENT POINTS DIAGRAM (-680)

14.11 TERMSET MODULES

The Termset modules are used for converting a 2-Wire, Loop Start (LS), Ground Start (GS) or Reverse Burst (RB) circuit to a 4-Wire E&M for use with the Switch 4-Wire E&M board.

14.11.1 EQUIPMENT SETUP

NOTE: Use Type V signaling on E&M for Tellabs cards.

14.11.2 INITIALIZING THE TELLABS CARDS

Switch Settings on 6132B (POTS Applications), see Table 14-9. POTS lines use the Tellabs 6132B Termset. Initialize the Termset switch settings, see Figure 14-22.

Table 14-9 TELLABS 6132B - POTS

Sw	Purpose
S14	Initially set to NORM. If the E-Lead (Green LED) stays on constantly, or the termset does not answer in-dial, place S14 in REV position. This switch reverses the battery polarity presented to the E&M card from the CO in POTS applications. BYPASS (and removal of B subassembly) will allow 6132 to be used without signaling.
S5	Place in **2W**. This switch determines the interface.
S4	To get started, set to 900, with all capacitors in. Set to variable and adjust R38 when performing the actual balance. This balance network allows 600, 900 or variable resistor (2k) resistive balance. Also, 5 capacitors ranging from .002 µF to .032 µF in octaves (i.e. .064 µF total capacitance) provide for a capacitive balance.
R38	This potentiometer controls the resistive balance in the variable mode of S4.
S12	Supervisory Mode. Set to GS (Ground Start), LS (Loop Start), RB (Reverse Battery) allows the termset to detect battery reversal from the CO (if it is provided) which indicates hang-up).
S19	Set to **sig** for Loop Start, **inv** for Ground Start applications. This switch provides for normal (sig) or inverted (inv) E&M outputs.
S18	Set to **sig**. This switch provides for normal (sig) or inverted (inv) E&M inputs.
S11	Set to **B**. This switch swaps roles of E-Lead and M-Lead.
S3	Set to **600**. This switch provides 2W port terminating impedance.

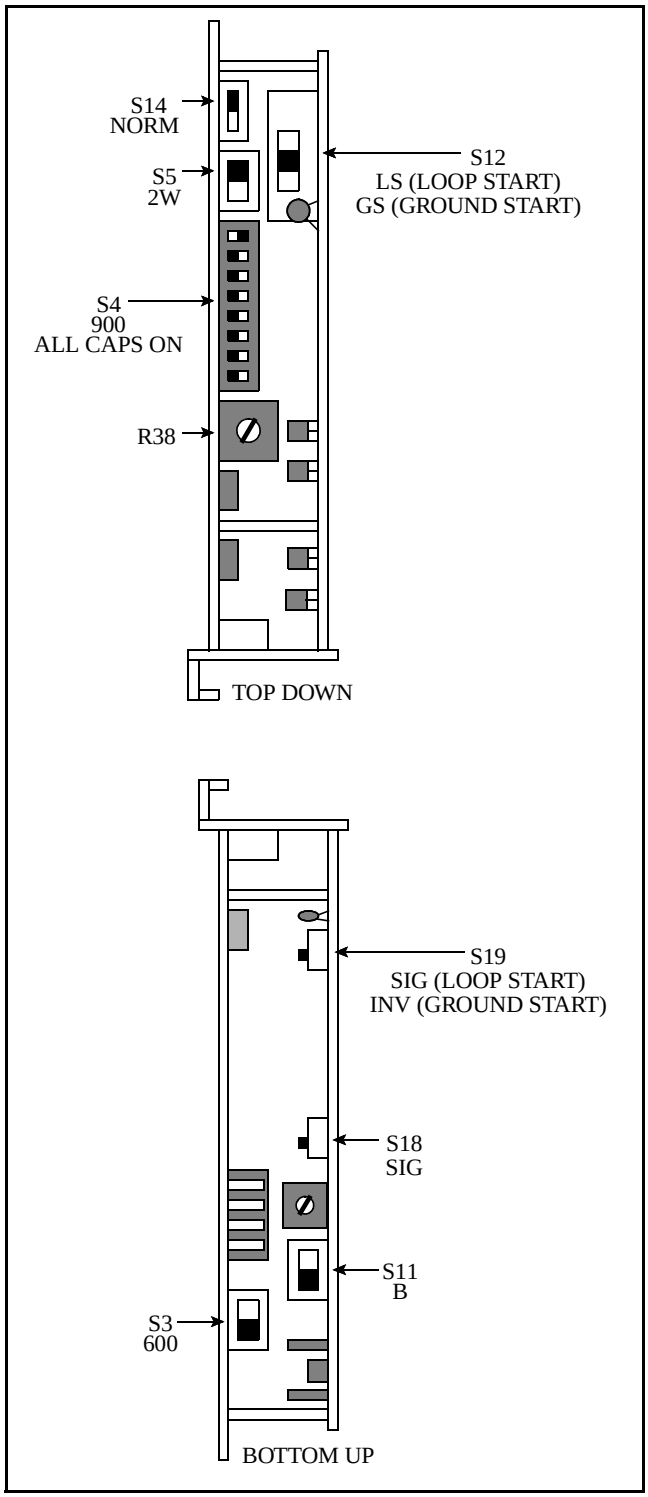


Figure 14-22 TELLABS 6132B - POTS

14.11.3 SWITCH SETTINGS ON 6132A (DID APPLICATIONS)

Table 14-10 TELLABS 6132A - DID

Sw	Purpose
S14	Initially set to **NORM**. If the E-Lead (Green LED) stays on constantly, or the termset does not answer in-dial, place S14 in **REV** position. This switch reverses the battery polarity presented to the CO from the Termset in DID applications.
S5	Place in **2W**. This switch determines the interface.
S4	To get started, set to 900, with all capacitors in. Set to variable and adjust R38 when performing the actual balance. This balance network allows 600, 900 or variable resistor (2k) resistive balance. Also, 5 capacitors ranging from .002 µF to .032 µF in octaves (i.e. .064 µF total capacitance) provide for a capacitive balance.
R38	This potentiometer controls the resistive balance in the variable mode of S4.
S11	Set to **B**. This switch swaps roles of E-Lead and M-Lead.
S12	Supervisory Mode. Set to RB (Reverse Battery) for DID applications.
S15	Set to **a = inv, b = inv, c = d = e = off**. 'a' sets up inverted E&M inputs. 'b' sets up inverted E&M outputs. 'c' sets up continuous (vs. interrupted ringing. 'd' sets up no ring-back tone. 'e' sets up no pulse correction.
S3	Set to **600**. This switch provides 2W port terminating impedance.

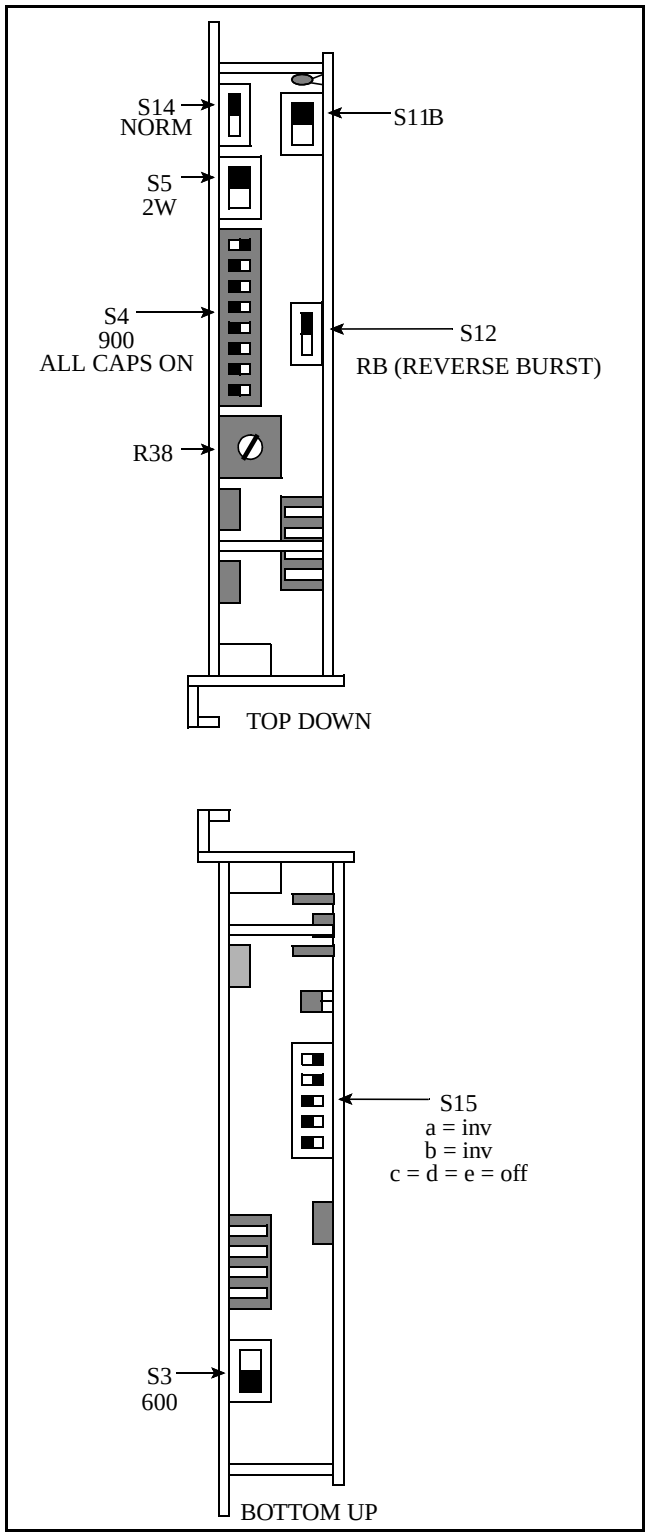


Figure 14-23 TELLABS 6132A - DID

14.11.4 XEL TERMSET RACK

Set up the equipment shown in Figures 14-24, 14-25 and 14-26.

1. Ensure that the jumpers have been installed on the backside of the XEL rack, where the power plug attaches (see Figure 14-24).
2. Ensure that there is a connection from Slot-12, pin 27 to the power connector ground pin (see Figure 14-24).
3. Attach the grounding strap to earth ground.
4. The XEL Rack requires -48V DC from the Switch. See Figure 14-24 for wiring.

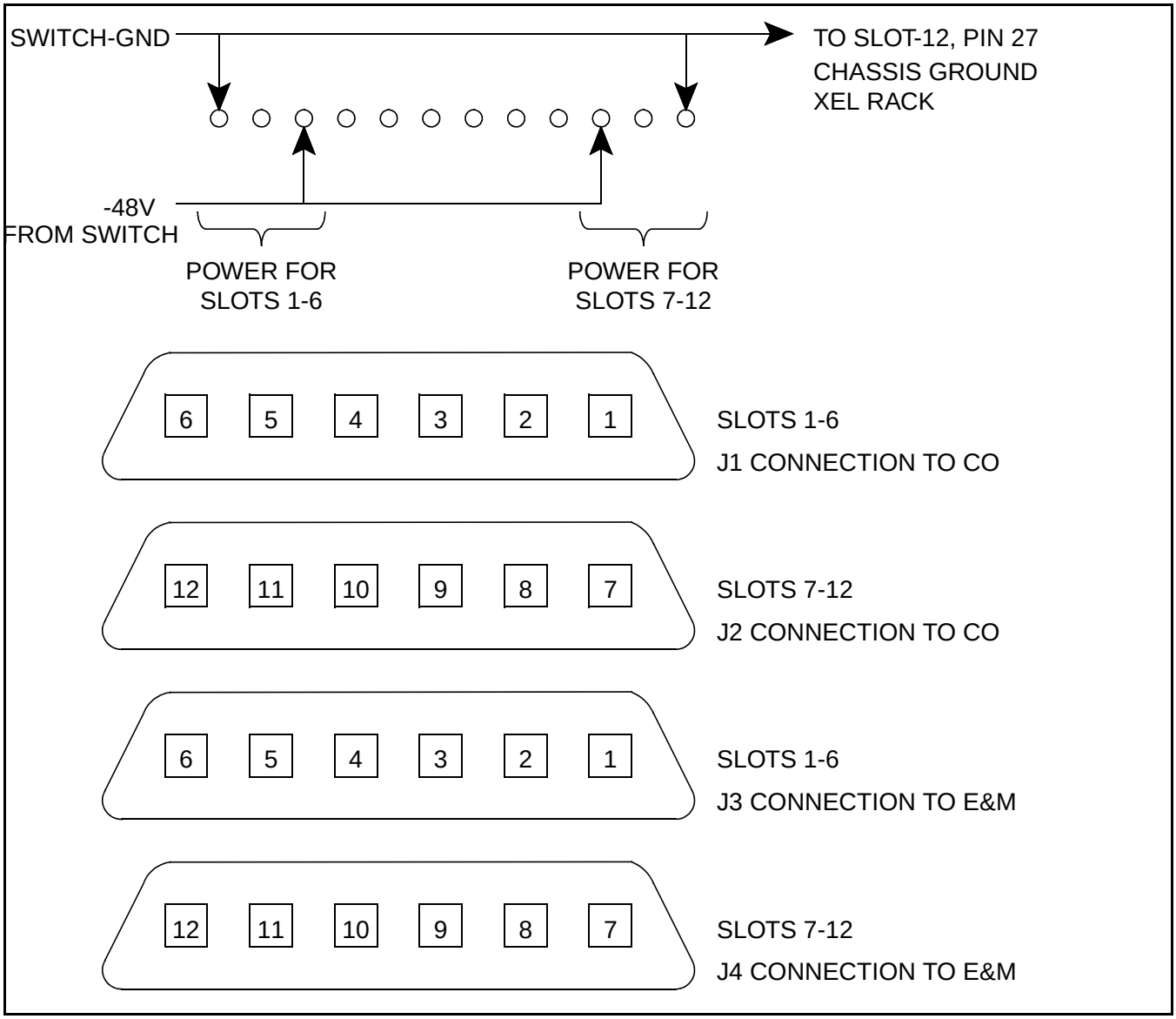


Figure 14-24 XEL TERMSET RACK (REAR CLOSE-UP)

14.11.5 CONNECTION TO THE PHONE LINES

1. **Method 1**: An RJ-11 harmonica to 50-pin connector J1 or J2. On the RJ-11 harmonica the slots 1-6 correspond to the RJ-11 jacks going from right to left as viewed from the back of the Termset rack (see Figure 14-26).
2. **Method 2**: A punch down block and a 50-pin to 50-pin cable that also attaches to J1 or J2. The phone lines then connect to the punch down block in positions corresponding to their location on the 50-pin connector.

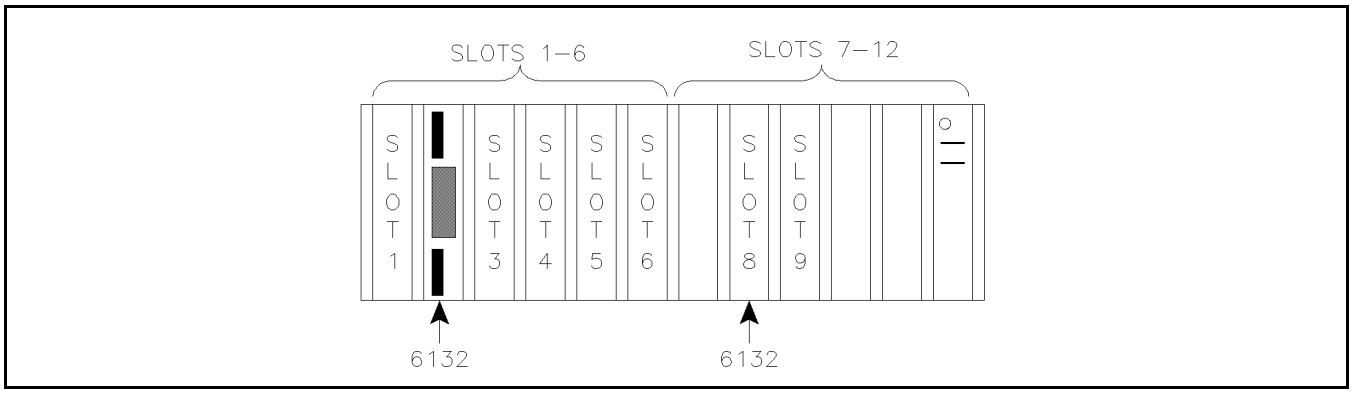


Figure 14-25 TERMSET RACK (FRONT VIEW)

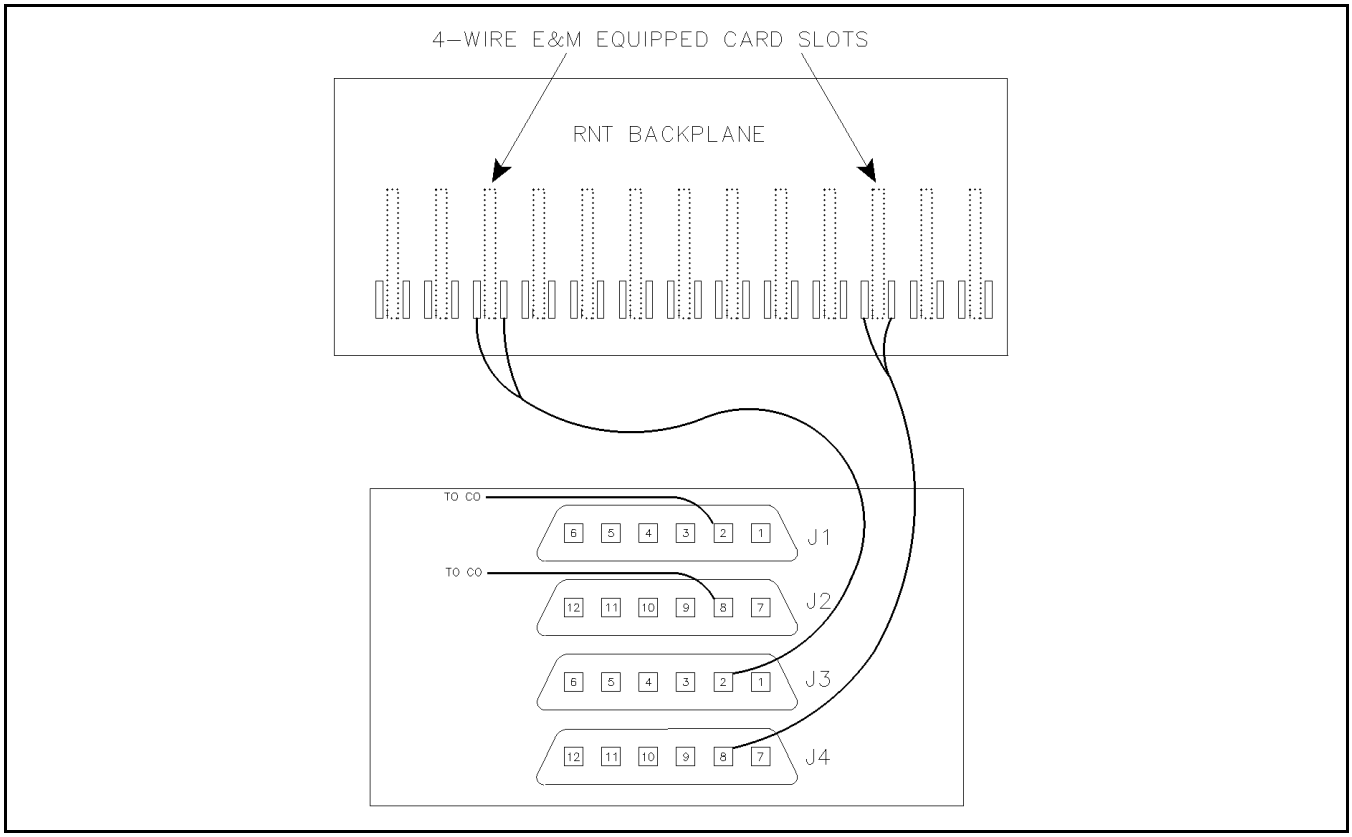


Figure 14-26 NETWORK LINK (SWITCH RACK BACK VIEW)

14.11.6 FINAL PATH INSPECTION

If all of the mechanical assembly has been made properly, the connections in Table 14-11 should exist.

Table 14-11 E&M TO TERMSET CONNECTIONS

SLOT 1				
6132/Backplane [1]		**J3 [2]**	**E&M DB-15 [3]**	
Pin #	**Signal**	**Pin #**	**Signal**	**Pin #**
41	Tx Tip	26	Rx +	1
47	Tx Ring	1	Rx Gnd	6
7	Rx Tip	27	Tx +	8
13	Rx Ring	2	Tx Gnd	10
21	M-Lead	29	E-Lead	13
23	E-Lead	28	M-Lead	14
SLOT 2				
6132/Backplane [1]		**J3[2]**	**E&M DB-15 [3]**	
Pin #	**Signal**	**Pin #**	**Signal**	**Pin #**
41	Tx Tip	30	Rx +	1
47	Tx Ring	5	Rx Gnd	6
7	Rx Tip	31	Tx +	8
13	Rx Ring	6	Tx Gnd	10
21	M-Lead	33	E-Lead	13
23	E-Lead	32	M-Lead	14

[1] Information from Page 10 of 6132 handout, corresponds to page 5 of rack handout.
[2] Information from Page 4 (Table 3) of rack handout.
[3] Information from E&M card schematics.

14.12 BACKGROUND INFORMATION

14.12.1 STANDARD SIGNAL

The standard signal is defined as a 1 kHz audio tone modulated to ±2 kHz deviation, with data modulated to ±1 kHz (total deviation is ±3 kHz).

14.12.2 OUTLINED OBJECTIVE

The specific technical purposes of tuning the repeater and 4-Wire E&M are to ensure:

1. The RF hardware is properly tuned.

2. Data levels (LTR and high speed) are properly set, both in/out of the Radio Concentrator.

3. In dispatch mode, Audio In = Audio out of the repeater.

4. Levels transmitted to and received from the CO are given adequate gain.

5. The hybrids interfacing system equipment to the CO are properly balanced.

6. The links all have unit gain across them.

7. Interconnect and Dispatch audio are at the same level (in terms of Exciter deviation).

The purpose of tuning the Switch is to ensure all audio coming into the Switch, either from an RF channel, a Telco resource, or a Network Link, bus at the same level. In other words, regardless of where audio originates, the amplitude is the same level in the Switch. Once achieved, the Switch directs the audio *in from* any resource *out to* any other resource with all the proper levels.

Standard audio received from a mobile is defined in terms of ±2 kHz of audio deviation (±3 kHz total). Defining standard audio from the Central Office (CO) is not as simple. It ranges from -10 to -30 dBm, depending on distance from the CO and line quality. One objective of the tuning procedure is to determine the level of average audio from the CO, and to normalize that level.

Tuning the system ensures that ±2 kHz of audio received from a mobile results in the same level on the backplane as does the CO standard level.

Once the levels are properly set, ±2 kHz of audio deviation is injected into the receiver and ±2 kHz of audio deviation is transmitted from the Exciter (dispatch). Also, standard audio coming in from the CO results in ±2 kHz of audio deviation transmitted from the Exciter (interconnect). Finally, ±2 kHz of audio deviation injected into the Receiver results in a standard audio level transmitted to the CO.

14.12.3 THE ORDER OF THINGS

First, properly tune the RF equipment. Next, the repeater (dispatch) channels. ±2 kHz of audio in, gives ±2 kHz of audio out.

Once the repeater channel is tuned, it is used as a tool in tuning the interconnect channel. Average audio transmitted to the CO is defined as -7 dBm. ±2 kHz of audio deviation in from a repeater is transmitted to the CO at a level of -7 dBm. Similarly, -7 dBm going to the CO from a remote location results in ±2 kHz of audio transmitted from the Exciter. The level at tip and ring locally, with -7 dBm injected remotely, is the average audio level from the CO (-10 to -30 dBm, typically -20 dBm).

14.13 TUNING A DOD OR DID 2-WIRE INTERFACE TO THE 4-WIRE E&M BOARD.

Refer to Figure 14-27 for this Section.

1. Establish an interconnect to a remote location, using the DOD or DID line to be tuned.

2. Collect the call with a service monitor and encoder box. Data level is 1 kHz.

3. Turn the radio off (do not end call). Monitor and encoder are now collecting the call.

4. Inject a standard tone (±2 kHz audio) into the receiver.

5. Use a bantam jack to monitor Tip and Ring (2-Wire transmit in/monitor) at the Termset (see Figure 14-28).

6. Adjust R44 (Tx Gain) on the E&M Main Board for a level of -7 dBm (346 mV RMS, 978 mV P-P) at Tip and Ring of the Termset. If R44 does not have enough range, use dip switches on Tellabs cards for more adjustment.

7. Adjust the balance circuit of the Termset (see Figures 14-22 or 14-23) for minimum Exciter deviation or RMS voltage at J11 on the E&M Main Board. See Section 14.14 for additional information on reflected energy levels from the CO.

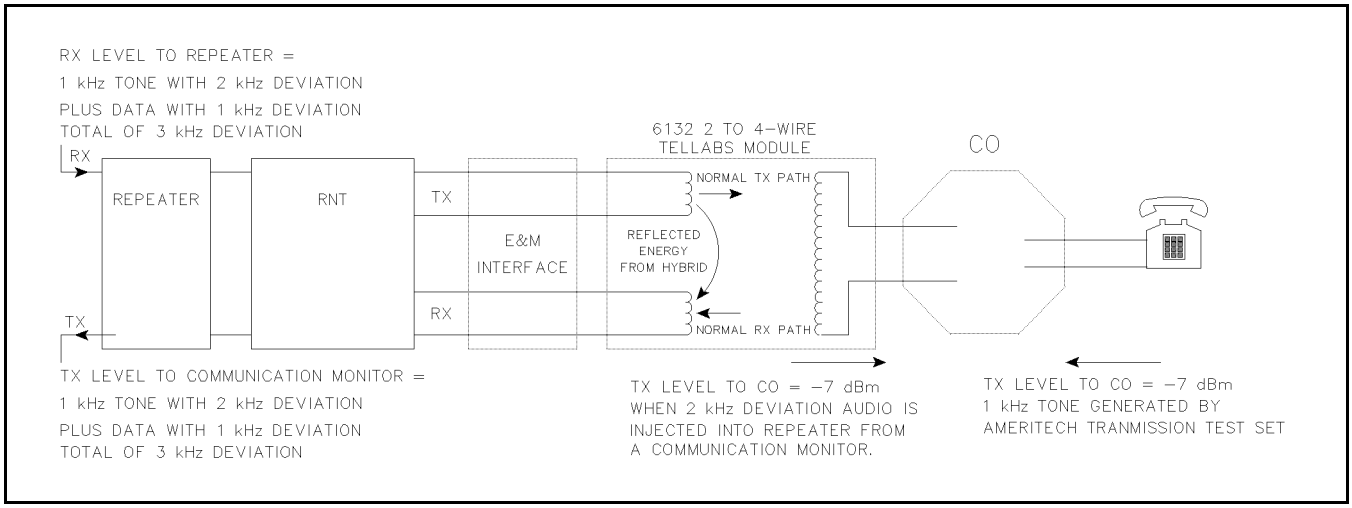


Figure 14-27 E&M INTERFACE

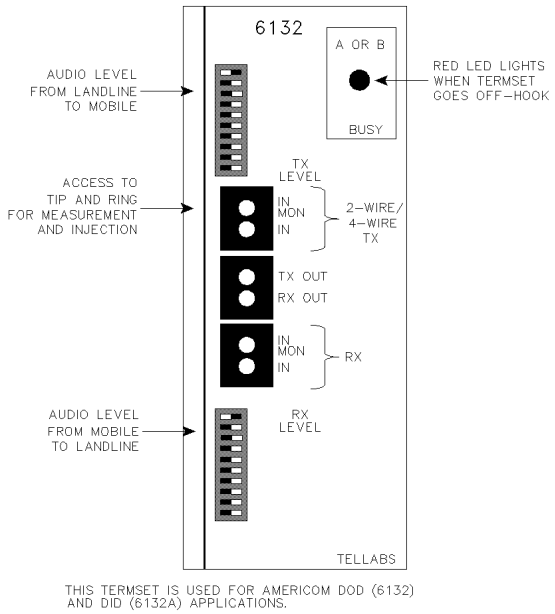


Figure 14-28 TELLABS 6132A/B TERMSET

8. A good way to measure the effectiveness of the balance across the Tellabs hybrid is to send a tone towards the CO and measure the energy reflected. A clear way of accomplishing this is to establish an interconnect, then inject a 1 kHz tone at ±2 kHz modulation into the Receiver. With ±2 kHz of audio going in towards the CO, measure the amount reflected out of the Exciter with a communication monitor or measure pin 1 with respect to pin 7 on the E&M card. A good balance, usually with the addition of a 0.033 µF capacitor across the Tellabs balance network, will result in virtually nothing but data coming out of the Exciter. A very poor balance can send the Exciter to the limiter. A breakdown follows:

Reflected Energy Above Data	**Balance Quality**
0-200 Hz (Out of Exciter Receive on E&M 0-16 mV RMS)	Great. No further adjustments are necessary.
200-500 Hz (16-37 mV RMS)	Good. Try to lower this by placing additional capacitance (0.033 µF, non-polarized caps) in parallel with the Termset LSB cap. This system, however, will sound good with no further adjustments.
500-1500 Hz (37-86 mV RMS)	Poor. Definitely try to lower this reflected energy by adding capacitance to the balance circuit.
1.5-4 kHz (86 mV-1V RMS)	Unusable. More energy is reflected than is sent into the CO. May be acceptable if all users are half-duplex. A full duplex radio will not work on this system.
Reflected Energy Above Data	**Balance Quality**
>4 kHz (>1V RMS)	Reset the limiter on the Exciter. The balance is poor and a maladjusted audio limiter.

9. After the reflected is minimized, check the Tx level to the CO for -7 dBm.

10. Turn off the tone, but keep the call going.

11. Inject a 1 kHz tone onto Tip and Ring at the remote location. A good remote location would be the SMR operator's shop (vs the operator's site), or any CO exchange other than the one at the site. Inject the tone into Tip and Ring using a Telephone Test Set. Setup the remote location for a 1 kHz tone at -7 dBm (346 mV RMS, 978 mV P-P) on Tip and Ring at the remote location.

NOTE: If a remote location is not used for injecting onto Tip and Ring, interconnect and dispatch levels will likely be different. Typically, if audio is injected from a telephone line of the same CO exchange and the Exciter deviation set for ±2 kHz of audio, the same level injected into a line from a different exchange will result in less than ±2 kHz of audio from the Exciter. Injection can be done locally as long as the difference is made up by placing dispatch and interconnect calls and comparing the levels. Make up for differences using the Tellabs Termset dip switches.

12. Monitor the Exciter deviation.

13. Adjust R41 (Rx Audio) on the E&M Main Board such that ±3 kHz is transmitted from the Exciter (±1 kHz data + ±2 kHz audio).

14. Make several calls, interconnect and dispatch comparing the levels. Make minor adjustments as needed to ensure interconnect and dispatch are the same level. While the E&M Main Board potentiometers can be used for this fine tuning, it will be more convenient to use the Termset dip switches.

15. Remove the tone from Tip and Ring, and tear down the call. This telephone line is now tuned such that:

    a. ±2 kHz into the Receiver results in -7 dBm at Tip and Ring.

    b. Standard audio from the CO results in ±2 kHz Exciter audio transmitted.

    c. Network equipment is balanced to the telephone lines.

    d. Interconnect/Dispatch levels are equal.

14.14 BALANCING TO THE CENTRAL OFFICE

14.14.1 INTRODUCTION

Tellabs places a circuit on their Termsets that balances to 4k/ft of standard 2-Wire line. This is 24 gauge cable with specification of 0.016 µF/1000 ft. That's why Tellabs provides a total of 0.064 µF of capacitance in their balance circuit.

14.14.2 STATISTICS

The Tellabs 6132 has a maximum line drive capability of 7.2 miles. The capacitance specification for 24 gauge (commonly used) station cable is 0.044 µF/mile. The maximum capacitance of a line will therefore be 7.2 x 0.084 mF = 0.605 mF. But, the maximum capacitance of a 6132 balance circuit is 0.064 µF.

These figures show that it may be necessary to add additional capacitance to the 6132 balance circuit to improve the balance.

14.14.3 ADDING CAPACITANCE TO THE TERMSET

Capacitance may be added to the Termset (see Figure 14-29) by soldering non-polarized, 0.033 µF capacitors in paralleled with the capacitors in the balance circuit of the Tellabs Termsets. Start with the least significant capacitor (0.002 µF) and work towards the most significant if necessary. See the handout for the 6132 for the locations of these capacitors.

14.14.4 RURAL AREAS

It will be typical of rural sites to find that the 2-Wire line leading to the CO (and, eventually, another hybrid to convert to 4-Wire for the telephone company) is longer than 4000 feet. When this is the case, the capacitance in the Tellabs balance circuit is inadequate for the task. If all of the Termset capacitors have been placed in line to minimize the balance, then try placing (soldering) additional capacitors across the LSBs of the Tellabs cards as described above.

14.14.5 URBAN AREAS

In other cases, there may not be enough cable between the Termset hybrid and the CO hybrid. Near large building (e.g. hotels, office buildings, etc.) the CO will place a SLIC pedestal, or digital switcher. In these cases, there may only be a few hundred feet between the Tellabs hybrid and the CO hybrid. This is likely the case if, when balancing, the addition of any capacitance at all degrades the balance. All that can be done to minimize reflected energy is using the variable resistor of the 6132 balance circuit.

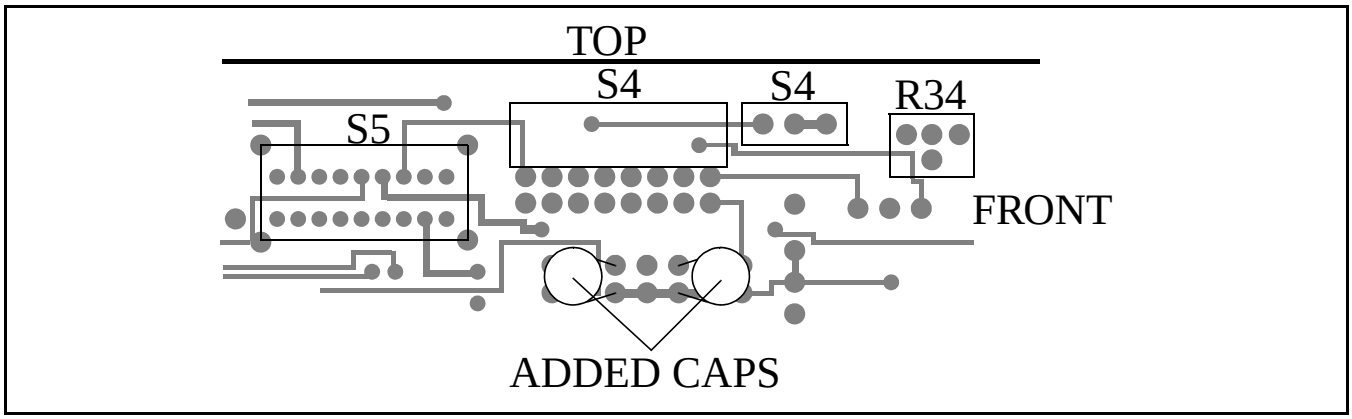


Figure 14-29 6132 TELLABS CARD

14.15 FCC USER INSTRUCTIONS AND CUSTOMER INFORMATION

NOTE: This information does not apply to the 4-Wire E&M. The 4-Wire E&M does not direct connect to the telephone company equipment.

In order to connect a DID or 2WY system to the network, provide the telephone company with:

1. The quantities and USOC numbers of the required jacks (Table 14-12).

2. The sequence for trunk connections.

3. The facility interface codes by position.

4. The ringer equivalence number or service order code, as applicable, by the position.

This equipment complies with Part 68 of the FCC rules. A label with the FCC registration number and Ringer Equivalence number (as applicable) for this equipment is on the rear access door.

The REN (as applicable to the service provided by the Telco) is used to determine the number of devices you may connect to the telephone line and still have assurance that all devices ring properly when called. In most, but not all areas, the sum of the RENs of all devices should not exceed 5.0. To be certain of the number of devices you may connect to each line, call the local Telco and request the maximum allowable REN for the calling area.

If any of your telephone equipment causes harm to the network, the Telco may discontinue your service. If possible, you will be notified in advance, otherwise you will be notified as soon as possible. You will also be advised of your rights to file a complaint with the FCC.

The Telco may make changes in its facilities, equipment operations, or procedures, that could affect the proper operation of your equipment. Advance notice will be given to provide an opportunity to maintain uninterrupted service.

In the event repairs are needed on this equipment, please contact: E.F. Johnson Co., Customer Service Department, Waseca, MN 56093-0514.

FCC rules prohibit the connection of customer provided equipment to central office implemented coin telephone service. Connection to party lines is subject to state tariffs. (Contact your state public service commission for information.)

Table 14-12 SYSTEM INFORMATION

TYPE OF INTERFACE	USOC	REN	SOC	FIC
DID (-660 Card Interface)	RJ-21X	------	9.0F	02V2-T
Loop/Ground Start (PSTN) (-670) Card Interface Reg # ATHUSA-61094-MF-E	RJ-21X	2.3B(AC)	9.0F	02LS2/02GS2

This page intentionally left blank.

SECTION 15 VOTER DIAGNOSTICS MODULE (VDM)

15.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 15-1 for the Basic Board block diagram. The Voter Diagnostics Module (VDM) controls the receiver voter system. This module communicates to the Call Processor via the Intra-Terminal Data Bus (IDB) and to the Receiver Voter Module(s) (RVM) via the Voter Control Bus (VCB). Voice communication does not take place on this module.

Refer to Voter Manual 001-3139-500 for more information on the VDM and the Voter system.

The VDM has the ability to enable and disable channels and sites, to inquire on the received signal strengths, and receive alarms from the RVMs.

15.2 VDM SETUP PROCEDURE

15.2.1 SWITCH SETTINGS

Refer to Figure 15-3 for Alignment Points Diagram.

Command and Control Communication

The command and control communication to the RVMs is by 1200 baud RS-232 data communication to the VCB via the secondary lines.

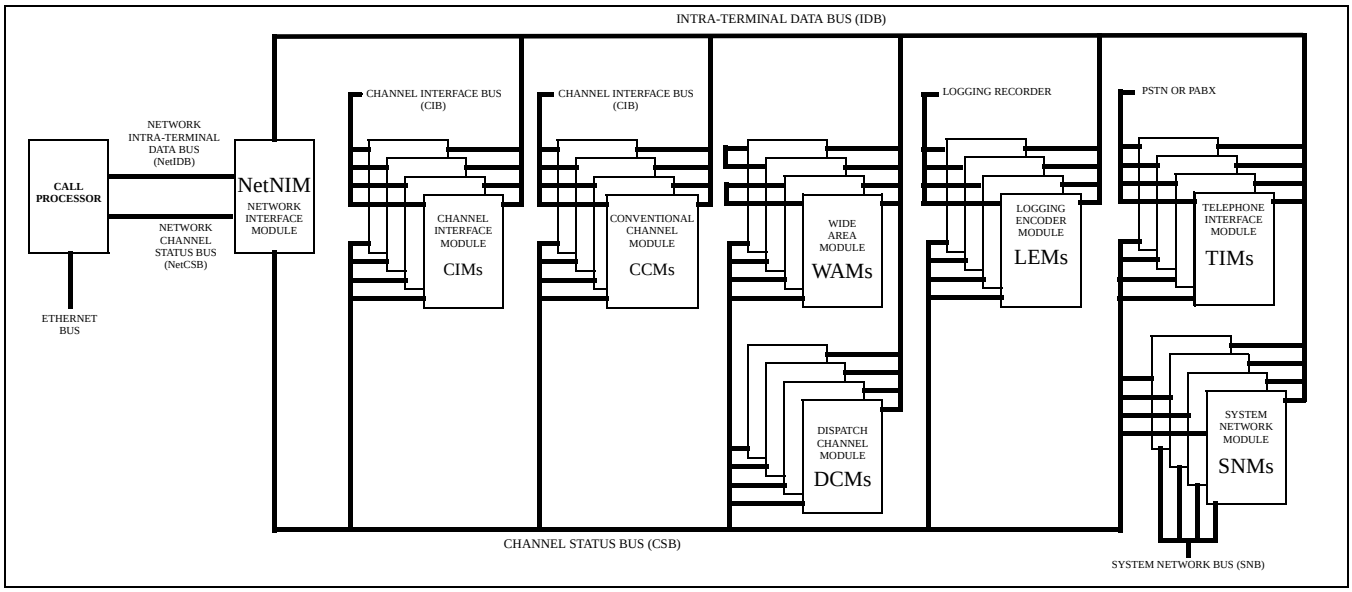


Figure 15-1 DATA BUSES

Table 15-1 VDM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
Digital Communication Using Secondary Lines.								
S1	1	2	-	4	-	-	3	-
S3	1	2	-	-	-	-	3	4
S4	-	-	3	4	1	2	-	-
S5	-	-	-	-	1	2	3	4

15.2.2 JUMPER PLACEMENT

Table 15-2 VDM BOARD JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2 2 to 3*	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not Used Normal Operation
P33	1 to 2* 3 to 4* 5 6	No personality card attached No personality card attached open open
J36	1 only* 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
*Setting for Normal operation.		

15.2.3 VDM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

Table 15-3 BACKPLANE PINOUTS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	Signal
pin 28	Sec Rx -	pin 2	Ground
pin 29	EA lead	pin 3	
pin 30	EB lead	pin 4	
pin 31	Pri Rx Audio+	pin 5	
pin 32	Pri Rx Audio-	pin 6	
		J2,4,6,8	
pin 59	Sec Tx +	Signal	pin 1
pin 60	Sec Tx -	Ground	pin 2
pin 61	MA lead		pin 3
pin 62	MB lead		pin 4
pin 63	Pri Tx Audio+		pin 5
pin 64	Pri Tx Audio-		pin 6

15.3 VDM ALIGNMENT SPECIFICATIONS

No alignment is required for the VDM. The setup procedures are to make the proper switch settings and connections.

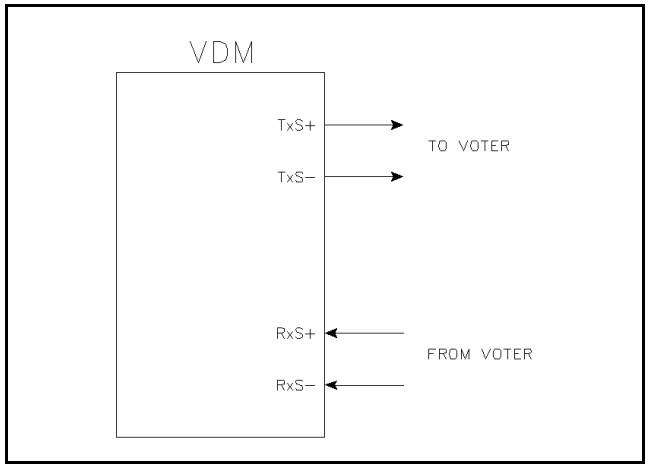


Figure 15-2 VDM I/O CONNECTIONS

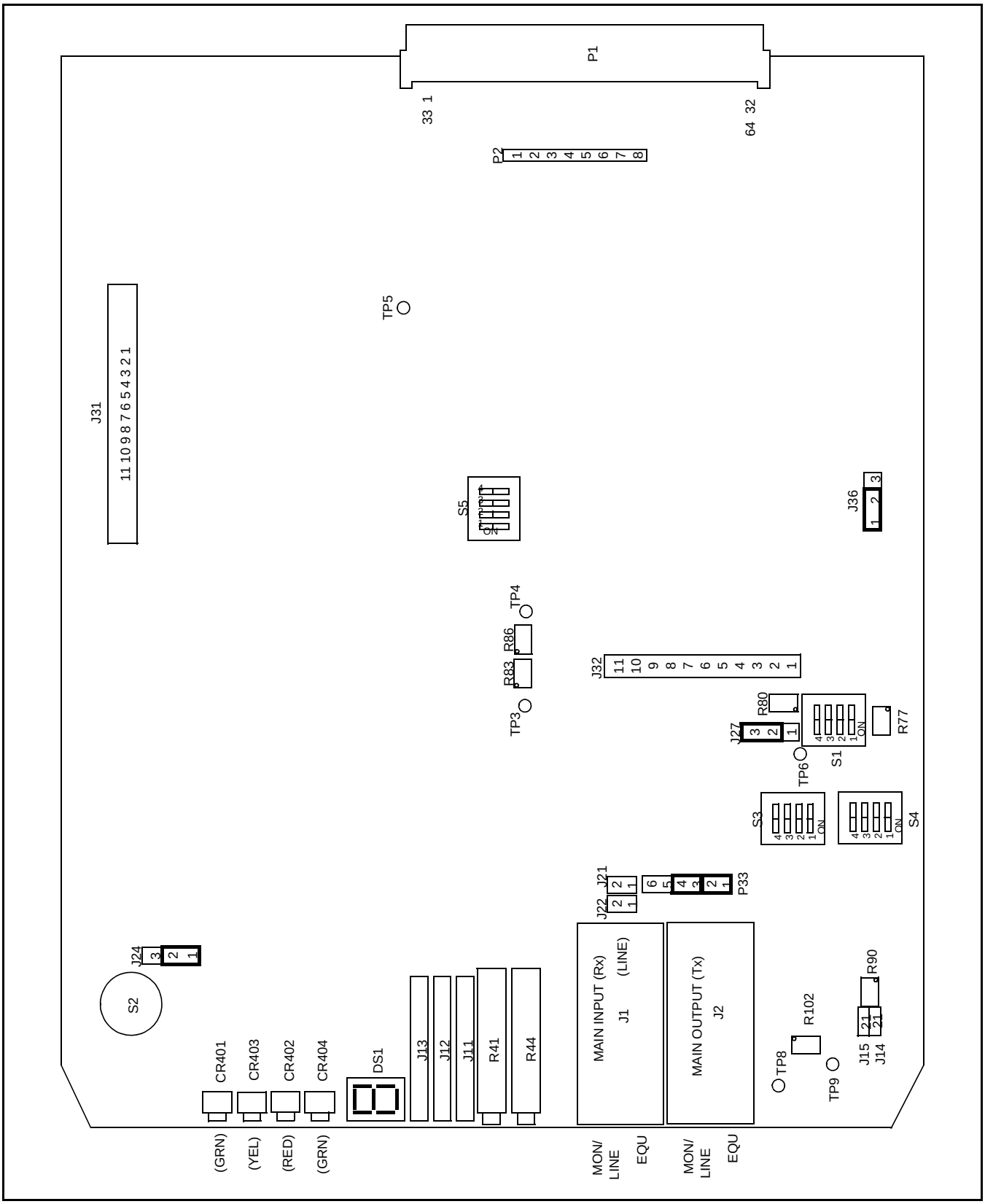


Figure 15-3 ALIGNMENT POINTS DIAGRAM

This page intentionally left blank.

SECTION 16 POWER TERMINATION MODULE (PTM)

16.1 DESCRIPTION

The Power Termination Module (PTM) provides loading of the Data Communication Busses (DCB) and PCM busses for each shelf. The PTM also provides each shelf with fuse protection for supply voltages.

16.2 SETUP PROCEDURE

Table 16-1 S5/S7 SWITCH TERMINATION SETTINGS

S5 - IDB Data (37.5 ohms) S7 - CSB Data (37.5 ohms)	
Number of Shelves	**Switch Sections Closed**
2	ALL
3	1,3,6,7
4	1
5	2,4,5,6,7
6	2,5,6,7
7	2,7
8	3,4,5,6,7
9	3,4,6,7
10	3,4
11	3,5,6
12	3,5
13	3,6
14	3,7
15	3
16	4,5,6,7
17	4,5,6,7
18	4,5,6
19	4,5,7
20	4,5
21	4,5
22	4,6,7
23	4,6,7
24	4,6

Table 16-2 S6/S8 SWITCH TERMINATION SETTINGS

S6 - IDB Idle (100 ohms) S8 - CSB Idle (100 ohms)	
Number of Shelves	**Switch Sections Closed**
2	8
3	4,5,7
4	1,2,6
5	5,6
6	2,5,6
7	1,3,6
8	6
9	2,3,4,5
10	1,2,4,5
11	4,5
12	1,2,4,5
13	1,4,5
14	1,2,5
15	1,2,5
16	2,5
17	5
18	5
19	1,2,3,4
20	1,2,3,4
21	1,2,3,4
22	3,4
23	3,4

Figure 16-1 POWER TERMINATION MODULE ALIGNMENT POINTS DIAGRAM

SECTION 17 LOGGING ENCODER MODULE (LEM)

17.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram. The Logging Encoder Module (LEM) is the interface that performs the data collection and outputs of information for recording voice traffic.

The LEM communicates with the other modules via the Intra-Terminal Data Bus (IDB) and monitors the Channel Status Bus (CSB) for the groups set up to use the LEM. The LEM is configured to monitor up to five channels for information. The LEM converts the CSB information for the five channels and outputs 1200 baud AFSK to a logging recorder. There may be up to six LEMs in a Switch to cover up to thirty channels.

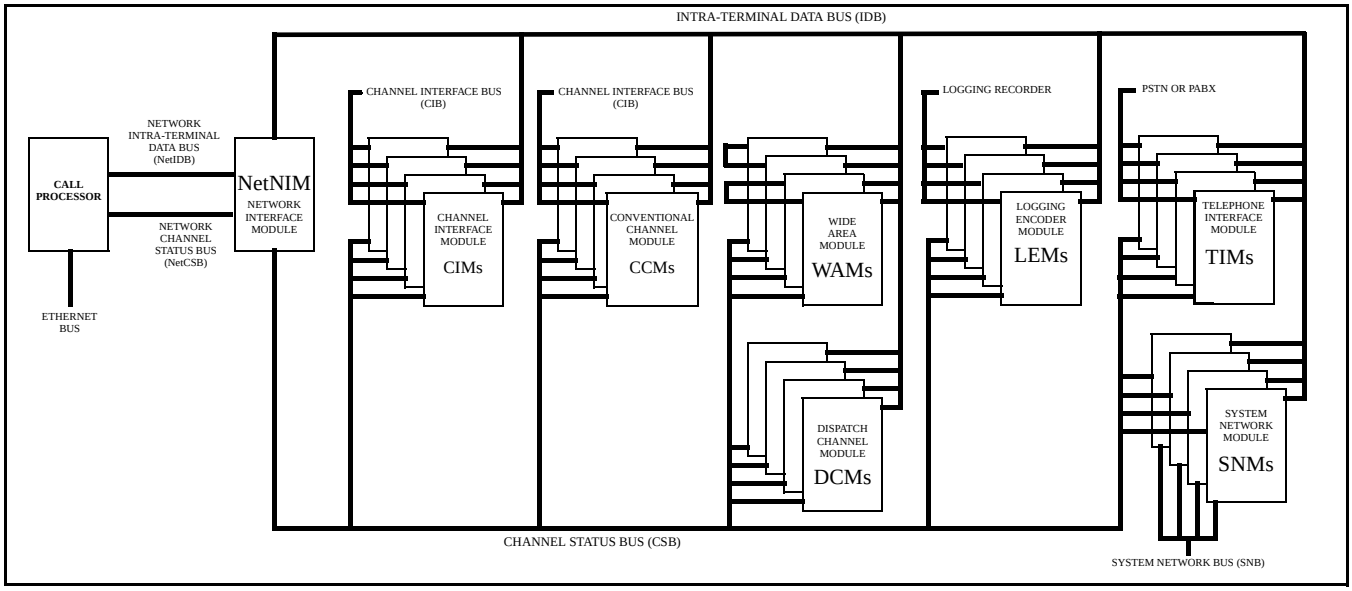


Figure 17-1 DATA BUS BLOCK DIAGRAM

17.2 LEM SETUP PROCEDURE

17.2.1 LEM SWITCH SETTINGS

See Figure 17-2 for Alignment Points Diagram.

Table 17-1 LEM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	2	-	4	-	-	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

17.2.2 LEM JUMPER PLACEMENT

Table 17-2 LEM JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not used Normal operation
P33	1 to 2 3 to 4 5 and 6	open open open
J36	1 only 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Indicates normal operation.		

17.2.3 LEM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

The main transmit audio of the LEM is the only external connection that is required. This connects to the logging recorder.

Table 17-3 LEM EXTERNAL CONNECTIONS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	RxS+
pin 28	Sec Rx -	pin 2	RxS-
pin 29	EA lead	pin 3	EA
pin 30	EB lead	pin 4	EB
pin 31	Pri Rx Audio+	pin 5	RxA+
pin 32	Pri Rx Audio-	pin 6	RxA-
		J2,4,6,8	
pin 59	Sec Tx +	TxS+	pin 1
pin 60	Sec Tx -	TxS-	pin 2
pin 61	MA lead	MA	pin 3
pin 62	MB lead	MB	pin 4
pin 63	Pri Tx Audio+	TxA+	pin 5
pin 64	Pri Tx Audio-	TxA-	pin 6

17.3 LEM ALIGNMENT SPECIFICATIONS

17.3.1 PRE-ALIGNMENT

The LEM is pre-aligned with the Basic Board Module alignment procedures. Refer to Section 7.3.

17.3.2 LEM ALIGNMENT PROCEDURE

The main transmit audio of the LEM is the only connection to the logging recorder. Good alignment practice should be followed and the module should be adjusted accordingly.

Connections to the LEM are:

1. Direct Connection

2. Leased Lines

3. Microwave Link

4. T1 Channel Bank Interfaces

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.

2. Set S5 for Test 1 (open section 1, close sections 2, 3 and 4).

3. Reset the module, Press S2 and release.

4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.

5. Set S5 for Test 8 (open section 4, close 1, 2 and 3).

6. Reset the module, Press S2 and release.

7. Adjust R86 to be -3 dBm ±0.5 dB at TP4.

8. Verify the level at J12 to be -12 dB ±1 dB from the maximum level from Step 1.

9. Select for normal operation (S5 all sections closed).

10. Reset the module, Press S2 and release.

    Example: Microwave has -16 dBm max input, set J12 for -28 dBm.

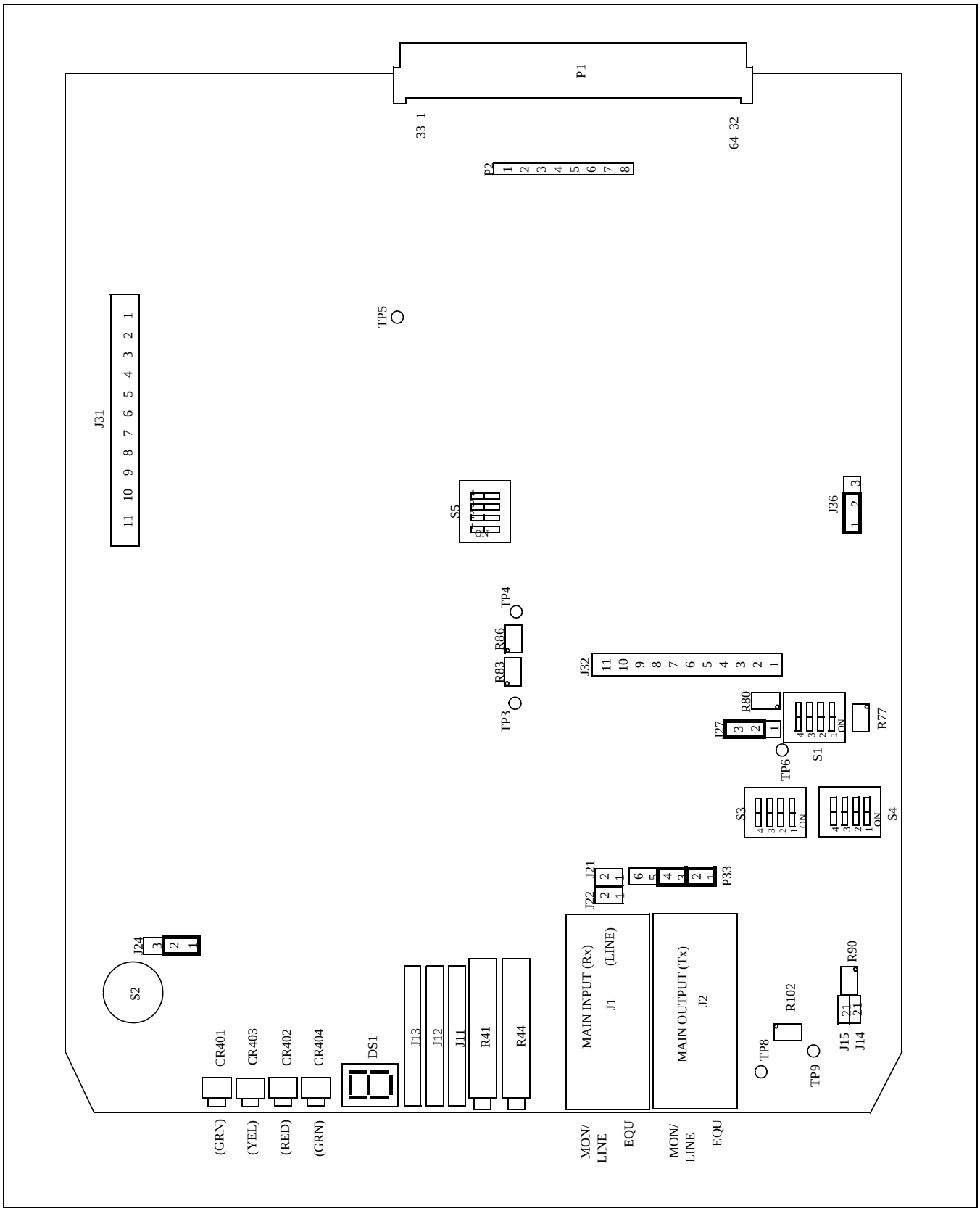


Figure 17-2 ALIGNMENT POINTS DIAGRAM

SECTION 18 VOICE TONE MODULE (VTM)

18.1 DESCRIPTION

The Voice Tone Module (VTM) provides tone and voice message to modules that indicate call progress to the users.

The VTM contains 8-fixed slots of digitized PCM audio messages stored in PROMs that are 4 seconds in length and repeat continuously on the VTM PCM bus of the Switch (see Table 18-3). The start of the message is indicated in the transmission so modules can present the audio message to the user from the beginning of the message. There may be up to four VTMs within a system, depending upon the messages required.

18.2 SETUP PROCEDURE

18.2.1 VTM JUMPER PLACEMENT

Table 18-1 VTM BOARD JUMPER PLACEMENT

JU	Pin	Description
J11 J12	2 to 2* 3 to 3*	Selects 27256 EPROM operation
	1 to 1 3 to 3	Selects 27128 EPROM operation
	1 to 1 3 only	Selects 2764 EPROM operation
J20	1 to 2	Transmit PCM Bus line
	2 to 3*	VTM PCM Bus line
*Setting for Normal operation.		

18.2.2 VTM SWITCH SETTINGS

Table 18-2 VTM BOARD SWITCH SETTINGS

Switch	VTM starting slot	Sections 1	2
S1	0* 8** 16 24	Closed Open Closed Open	Closed Closed Open Open
S2 - Monitor Switch. A front panel, 16-position switch with two positions for each slot. The switch selects the slot to be monitored at the front panel jacks.			
S3 - Reset. Normally open, press to reset. Momentary switch to reset module.			
* VTM 1 ** VTM 2.			

18.3 ALIGNMENT SPECIFICATIONS

No alignment is required for the VTM to operate in the system. However, panel jack output level is adjustable. The S1 switch setting must be correct for the starting slot number. Use S2 to select a voice or tone message.

1. Insert a "butt-set" in the front panel jack.

2. Adjust R22 for a comfortable listening level.

3. If a tone is selected, set the level at TP1, 9 dB lower than the level on U24, pin 2 for the proper level to the "butt-set".

NOTE: Revision 2 or earlier should have the line from P1, pin 1 to R25 cut. Revision 3 or later should have Jumper on -pin 1 only.

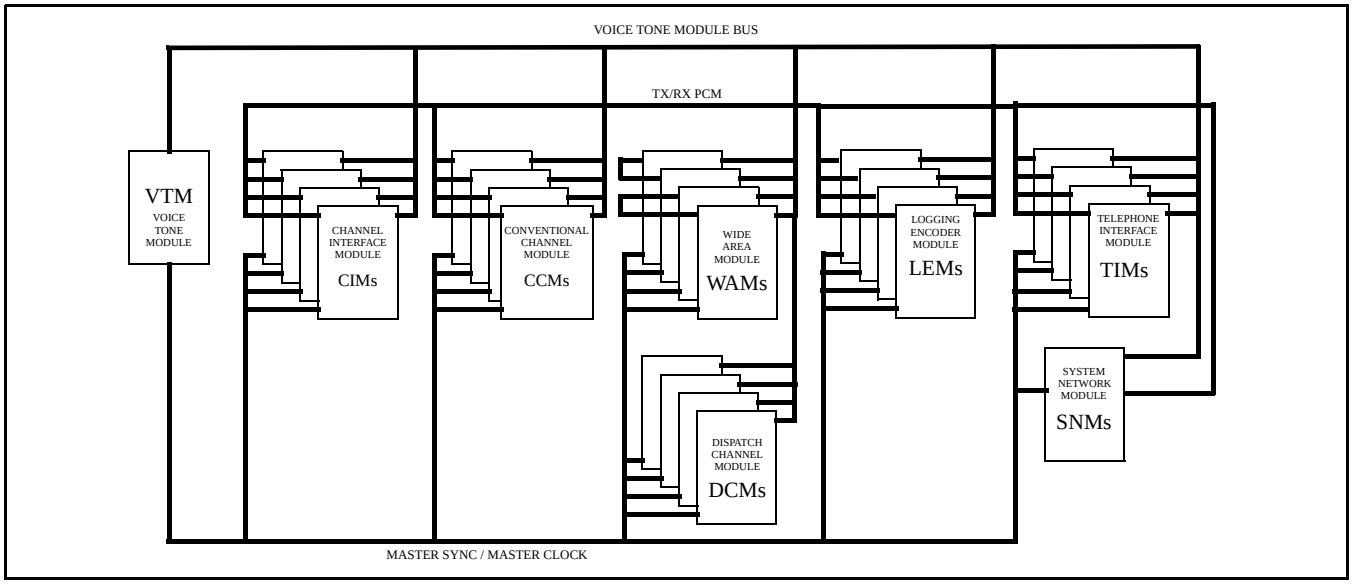


Figure 18-1 VOICE BUSES

Table 18-3 VTM PCM BUS MESSAGES

EPROM	PART NO.	SLOT	DESCRIPTION
VTM 1			
U3	023-9998-132	0	Silence with the PCM M-Lead set, Data of 0ffH
U4	023-9998-211	1	Busy Tone, 480 Hz and 620 Hz at -3 dBm at a 0.5 second ON and 0.5 second OFF rate with continuous PCM M-Lead set.
U5	023-9998-137	2	Intercept, 480 Hz at -13 dBm for 0.5 second, then 620 Hz at -13 dBm for 0.5 second rate with continuous PCM M-Lead set.
U6	023-9998-140	3	Alignment Tone, 1020 Hz at -6 dBm continuous with continuous PCM M-Lead set.
U7	023-9998-212	4	Dial Tone, 350 Hz and 440 Hz at -3 dBm continuous with continuous PCM M-Lead set.
U8	023-9998-184	5	1500 Hz at +6 dBm for 100 milliseconds with 750 Hz at +3 dBm for 100 milliseconds with continuous PCM M-Lead set.
U9	023-9998-213	6	Ringing Normal, 440 Hz and 480 Hz -3 dBm at a 1 second ON and 3 seconds OFF rate with continuous PCM M-Lead set.
U10	023-9998-214	7	End Call Tone, 1020 Hz at -3 dBm, 3 beeps at 0.1 second on, 0.1 off, 0.1 on, 0.1 off, 0.1 on, off, with a PCM M-Lead start pulse. There is 8 beep sets in 4 seconds.
VTM 2			
U3	023-9998-215	8	Queue Ringback Tone, 440 Hz and 480 Hz at -10 dBm at a 0.5 second ON and 0.5 second OFF rate with continuous PCM M-Lead set.
U4	023-9998-145	9	"The number you have dialed is not authorized."
U5	023-9998-146	10	"The system is busy."
U6	023-9998-147	11	"There are no lines available."
U7	023-9998-216	12	"Your call has been queued."
U8	023-9998-217	13	"You have been removed from the queue."
U9		14	Reserved and Undefined.
U10		15	Reserved and Undefined.

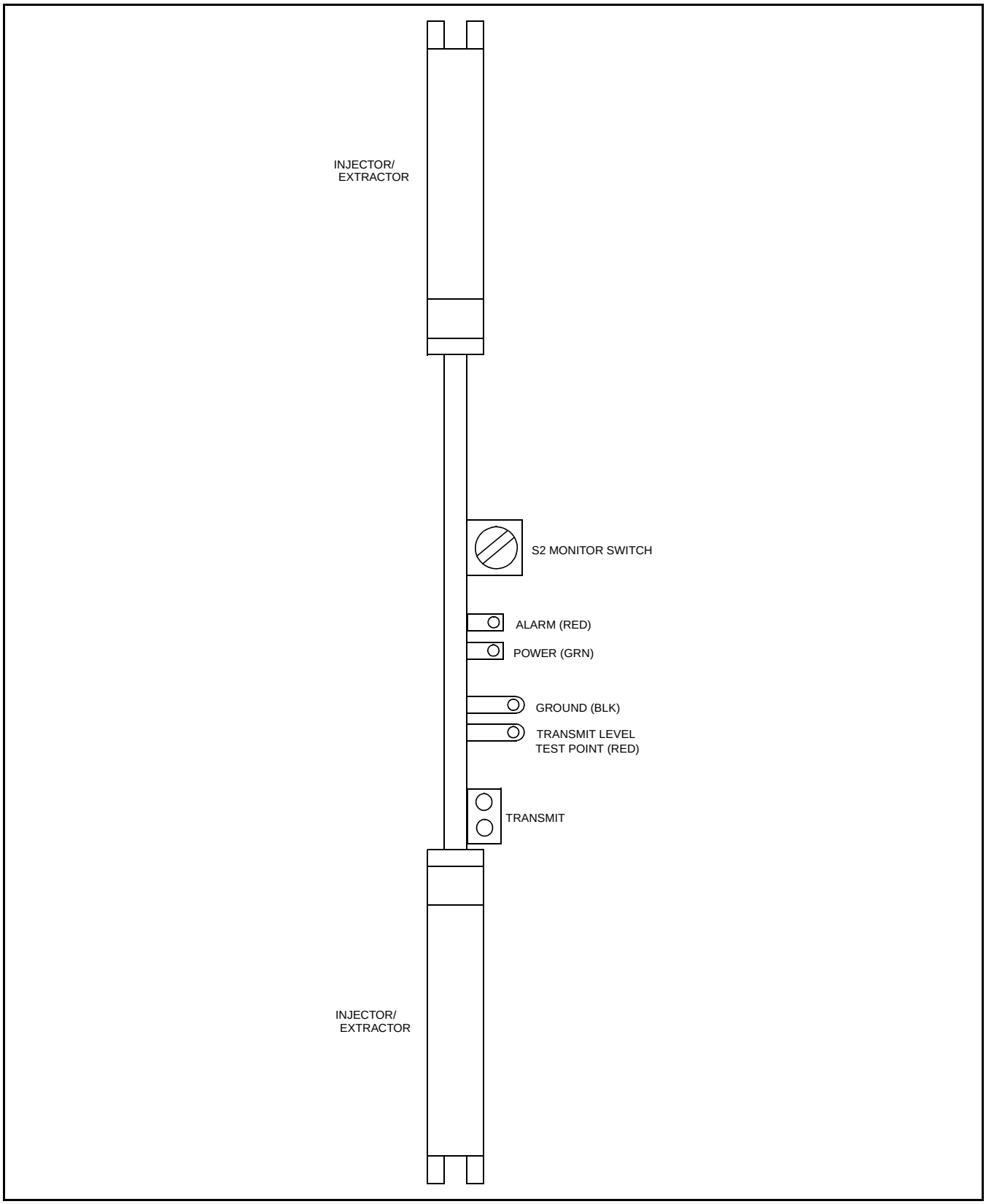


Figure 18-2 VTM CARD EDGE LAYOUT

This page intentionally left blank.

SECTION 19 WIDE AREA MODULE (WAM)

19.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 7-1 for the Basic Board block diagram.

The WAM communicates with the other modules via the Intra-Terminal Data Bus (IDB) and monitors the Channel Status Bus (CSB) for the groups setup to use the WAM.

The System and Subscriber Manager and Call Processor configures the WAMs for the Site/Home/Group ID combination for operation via the IDB. The System and Subscriber Manager provides a list of up to 30 sets of Site/Home/Group ID information. The System and Subscriber Manager can add a single set of Site/Home/Group ID information during operation of the WAM. The configuration can be made permanent or given a time to be active.

Once the WAM is configured, it begins call operation. The WAM monitors the CSB for activity of the configured Groups. The WAM receives the first active Group. The WAM acquires channels for the other Site/Home/Group IDs and switches or wraps the audio from the unit that is being received to the other Groups or channels.

If a Group is active on a Site, the WAM activates the other associated Groups on their appropriate Sites. Once the glare condition is ensured to be cleared, the M-Lead and E-Lead are enabled so the received audio is passed to the external interface of the WAM and the WAMs external M-Lead is activated.

When the received call goes idle the call goes into optional Hang Time, depending upon the System and Subscriber Manager configuration. When the Hang Time expires the call is dropped, or released, and the M-Lead is deactivated.

If both the receive and the external interface are active, the WAM sums the two audios together for transmission.

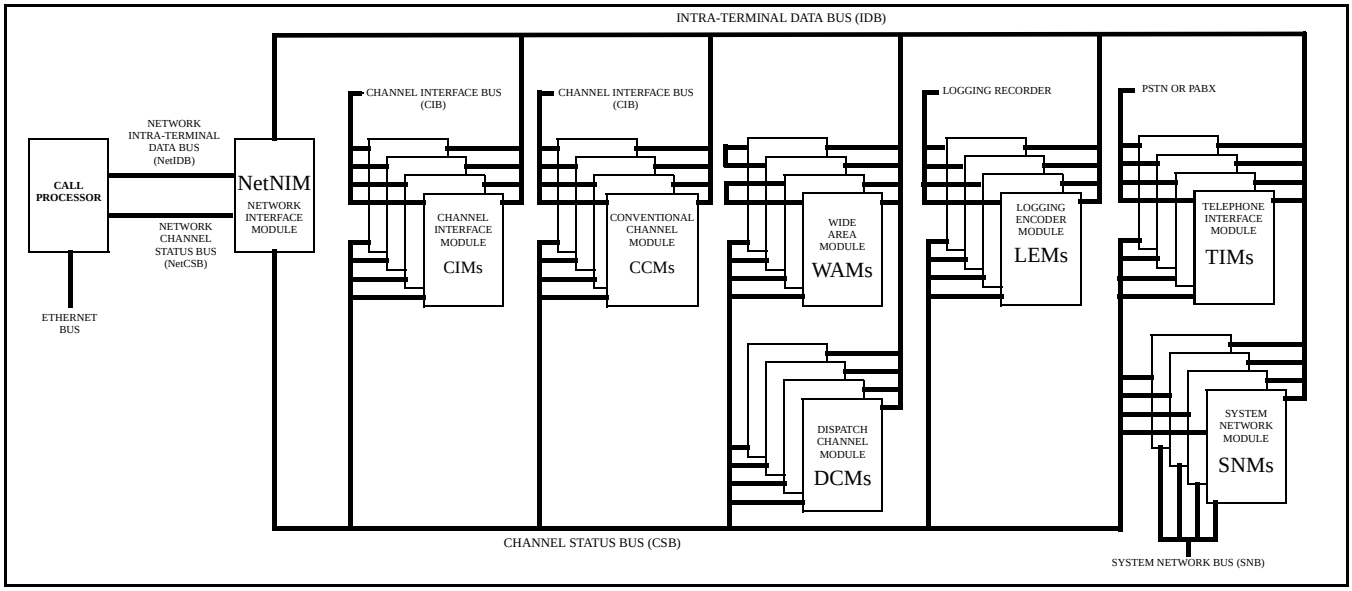


Figure 19-1 DATA BUS BLOCK DIAGRAM

19.2 WAM SETUP PROCEDURE

19.2.1 WAM SWITCH SETTINGS

See Figure 19-2 for Alignment Points Diagram.

Table 19-1 WAM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	2	-	4	-	-	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

19.2.2 WAM JUMPER PLACEMENT

Table 19-2 WAM JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2 2 to 3*	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not used Normal operation
P33	1 to 2 3 to 4 5 and 6	Jumpered Jumpered open
J36	1 only 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
* Indicates normal operation.		

19.2.3 WAM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

NOTE: An ECO to the WAM allows for an additional M-Lead output pair to the Backplane on TxS+ and TxS- (P34 to P45, pins 59/60).

Table 19-3 WAM EXTERNAL CONNECTIONS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	RxS+
pin 28	Sec Rx -	pin 2	RxS-
pin 29	EA lead	pin 3	EA
pin 30	EB lead	pin 4	EB
pin 31	Pri Rx Audio+	pin 5	RxA+
pin 32	Pri Rx Audio-	pin 6	RxA-
		J2,4,6,8	
pin 59	Sec Tx +	TxS+ (MA2)	pin 1
pin 60	Sec Tx -	TxS- (MB2)	pin 2
pin 61	MA lead	MA (MA1)	pin 3
pin 62	MB lead	MB (MB1)	pin 4
pin 63	Pri Tx Audio+	TxA+	pin 5
pin 64	Pri Tx Audio-	TxA-	pin 6

19.3 WAM ALIGNMENT SPECIFICATIONS

19.3.1 PRE-ALIGNMENT

The WAM is pre-aligned with the Basic Board Module alignment procedures; refer to Section 7.3.

19.3.2 WAM ALIGNMENT PROCEDURE

There are several external connections for the WAM, and good alignment practice should be followed and the module should be adjusted accordingly.

Connections to the WAM may take several forms:

- Direct Connection
- Leased Lines
- Microwave Link
- T1 Channel Bank Interfaces

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

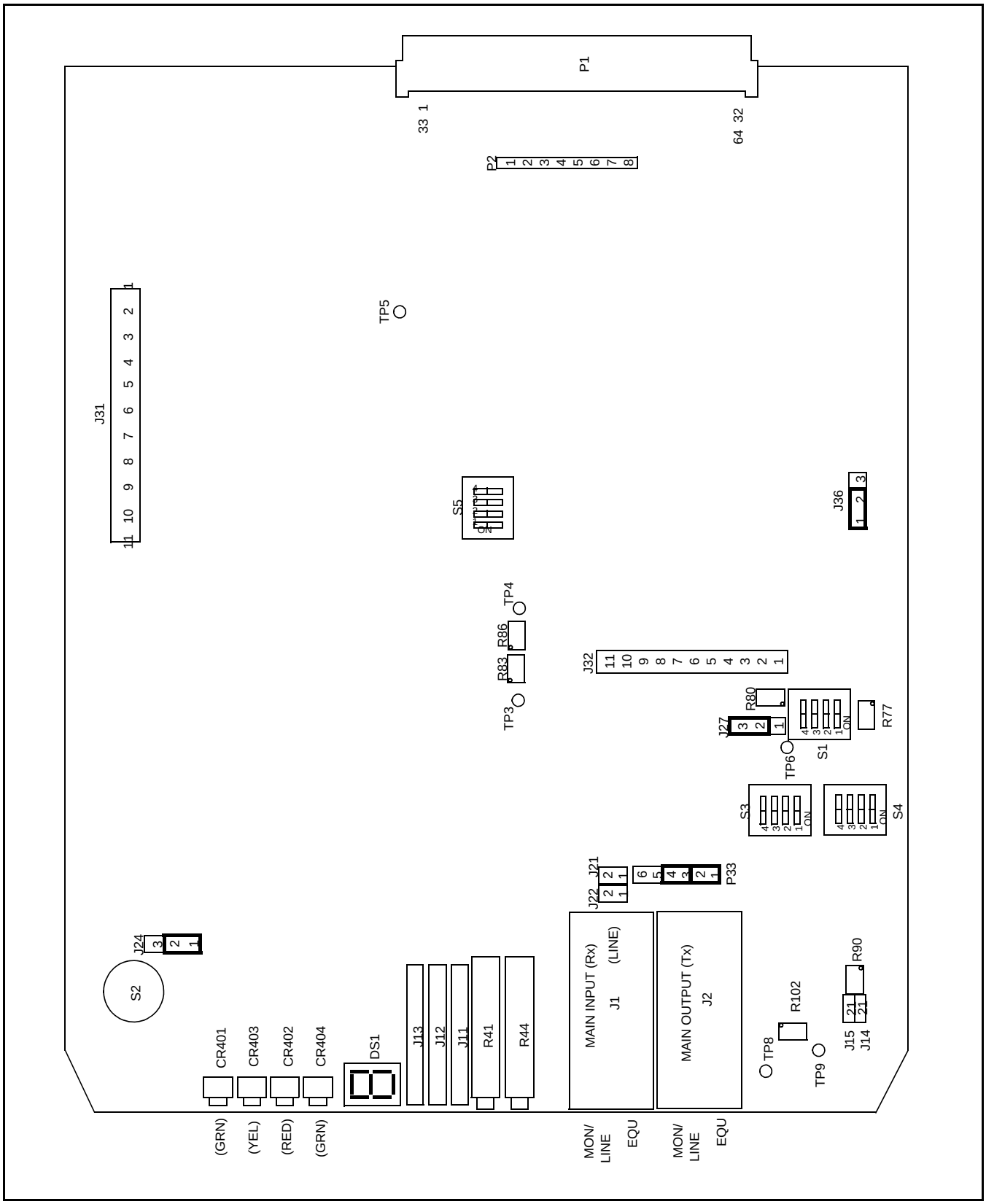


Figure 19-2 ALIGNMENT POINTS DIAGRAM

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.

2. Set S5 for Test 1 (open section 1, close sections 2, 3 and 4).

3. Reset the module, Press S2 and release.

4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.

5. Select for normal operation (S5 all sections closed).

6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm max input, set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.

2. Select Test 1 (S5 open section 1, close sections 2, 3, 4).

3. Reset the module, Press S2 and release.

4. Insert an alignment tone -12 dB from the level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.

5. Adjust R41 to be -6 dBm at J11, +6 dBm if maximum level is sent by the ancillary equipment.

6. Set S5 for normal operation (S5 all sections closed).

7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm maximum output. Apply -5 dBm and set J11 for -6 dBm or apply +7 dBm, then set for +6 dBm.

Secondary Transmit and Receive

Not used since the secondary line is not used.

19.4 WAM E&M-LEAD CONNECTIONS

NOTE: All WAM E&M Lead connection Examples and Figures reflect only one WAM configuration (WAC) and only one Switch per location.

- *Duplication of the following Examples and Figures are required for multiple, simultaneous WACs.*

- *Multiple Switches per location that are included in a WAC in any of the following Examples and Figures need to daisy-chain E-Lead inputs and M-Lead outputs and then connect them together. (An example that has one Location with three Switches is shown in Figure 19-3.)*

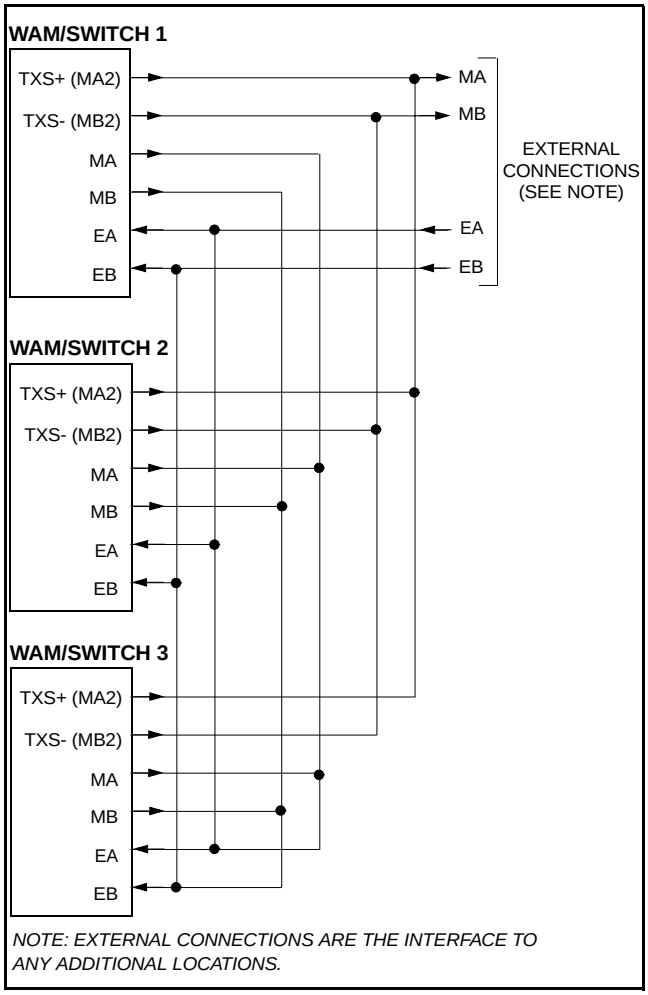


Figure 19-3 WAM E&M LEAD CABLE LAYOUT 1 LOCATION

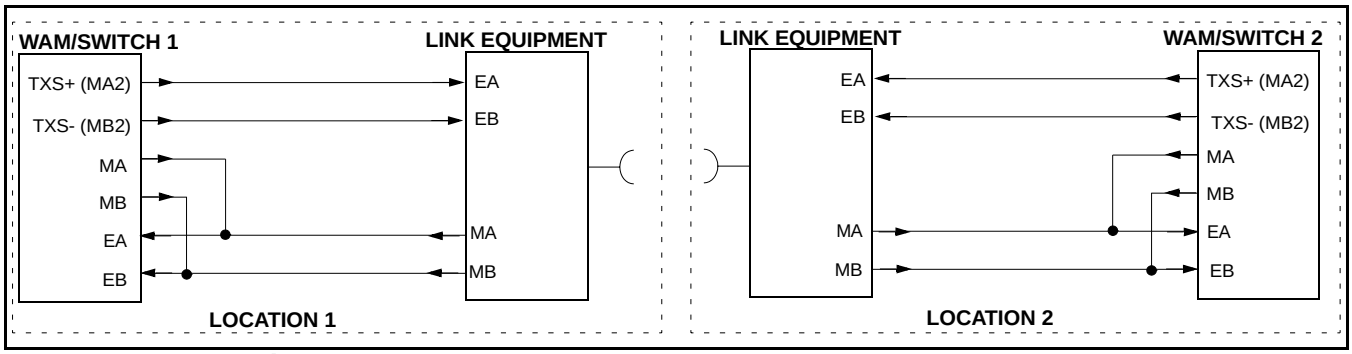


Figure 19-4 WAM E&M LEAD CABLE LAYOUT 2 LOCATIONS

19.4.1 ONE LOCATION

When only one WAM is used no E&M Lead external connections are necessary.

19.4.2 TWO LOCATIONS

Cross-connecting between the Switches/Links requires the use of the additional WAM M-Lead output (see Figure 19-4).

19.4.3 THREE LOCATIONS

A WAC that consists of three or more Locations with Switches/WAMs at each requires the use of the M-Lead Splitter Box (see Section 19-5). The Splitter Box splits one M-Lead input into six M-Lead outputs. Seven boxes would allow a total of seven Locations with Switches/WAMs at each to participate in a WAC before needing a second box per Location (see Figure 19-6).

NOTE: The M-Lead Splitter Boxes are needed only at the Locations where two or more E&M Links connect to WAMs. Notice in Figure 19-3 that the M-Lead Splitter Box is not needed since there is only one E&M Link interface.

19.5 M-LEAD SPLITTER BOX

19.5.1 GENERAL

The M-Lead Splitter Box Kit (PN 250-3239-300) is to be used with WAMs that allow Wide Area Calls (WAC) over links that utilize 4-Wire E&M Lead circuits. The M-Lead Splitter Box (PN 023-3239-300) provides up to six M-Lead outputs with one M-Lead input.

19.5.2 INSTALLATION

The box is powered by +12V on pin 1. The +12V supply can be obtained from the Switch Bus Bar. The spades of the cable (PN 023-3239-320) in the kit are connected to the bus bar (Red to +12V, Black to ground) and the stripped ends of the cables are connected to the terminal block of the M-Lead Splitter Box (Red to pin 1, Black to pin 2), see Figure 19-5.

A maximum of 10 boxes may be powered by one cable by daisy-chaining the rest of the power inputs.

Refer to System Configuration diagrams or Figure 19-6 for the usage of the M-Lead I/Os.

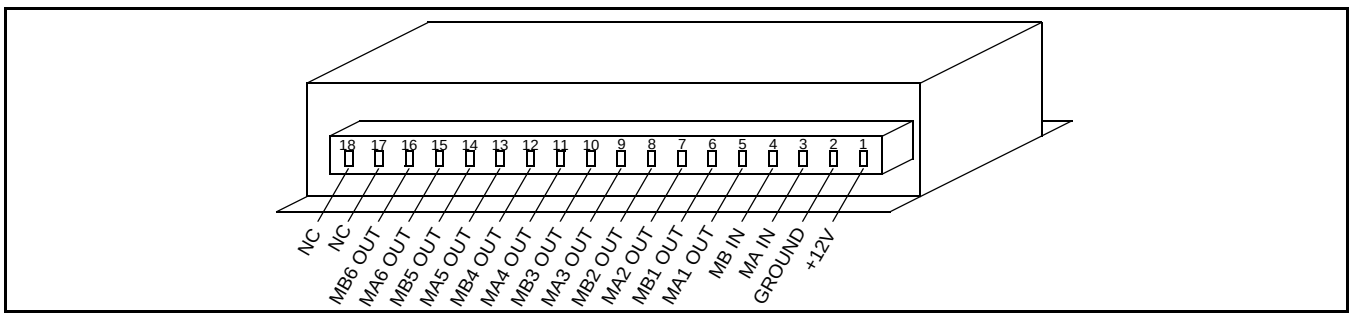


Figure 19-5 M-LEAD SPLITTER BOX I/Os

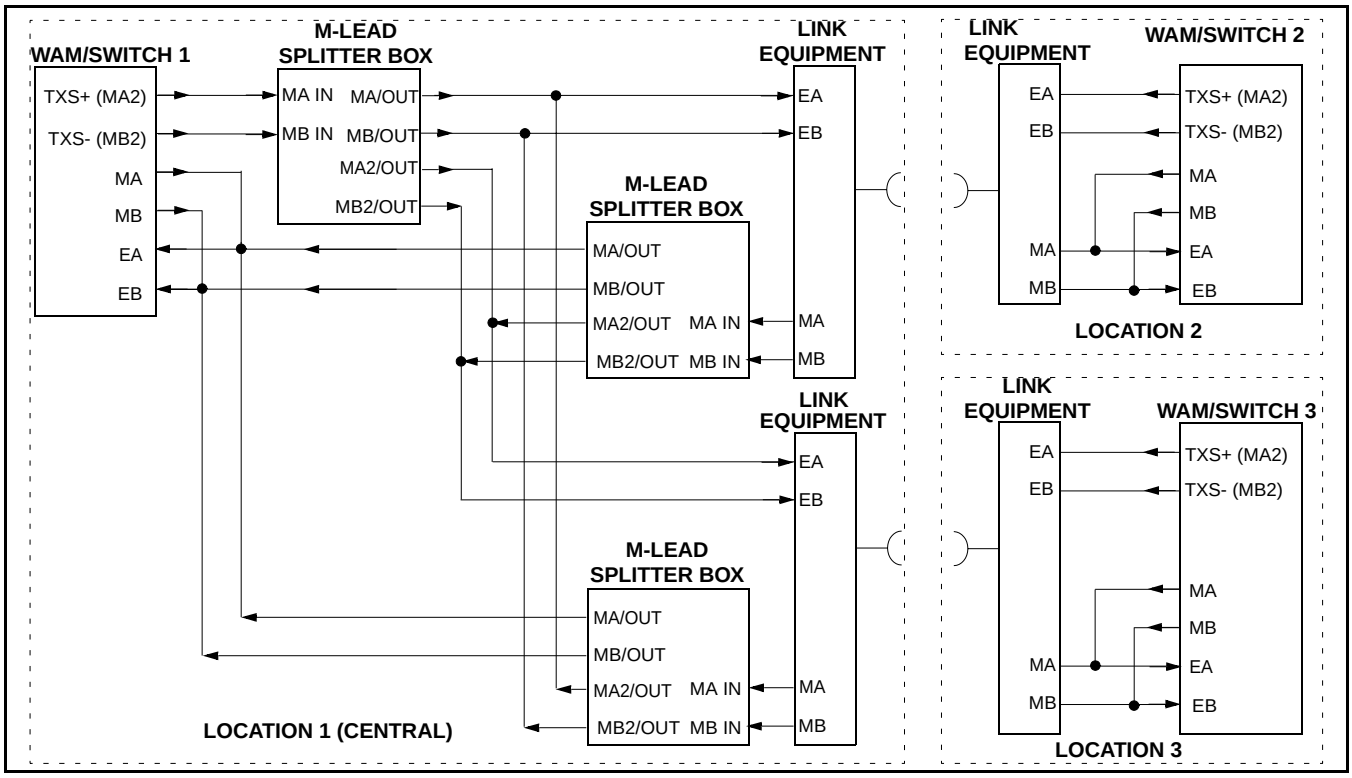


Figure 19-6 WAM E&M LEAD CABLE LAYOUT 3 LOCATIONS

19.6 WAM AUDIO CONNECTIONS

The audio of the WAMs are cross coupled to the other WAMs and back to themselves if circuitry permits. Connections to external circuits may require summing and distribution amps, depending upon the external interface.

When all Switches are co-located approximately 6 to 8 WAMs may be connected as shown in Figure 19-7.

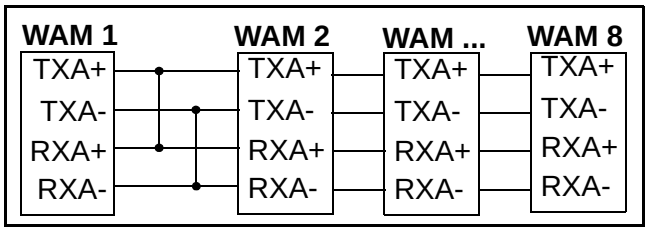


Figure 19-7 WAM AUDIO CABLE LAYOUT ONE LOCATION

A single WAM connected to a single external interface is shown in Figure 19-8. This may be accomplished by direct wiring. Care must be taken on alignment and loading of the external interface not to exceed line build out parameters or line levels. If this cannot be prevented then an external summation and distribution amplifier is required to avoid audio issues (see Figure 19-9).

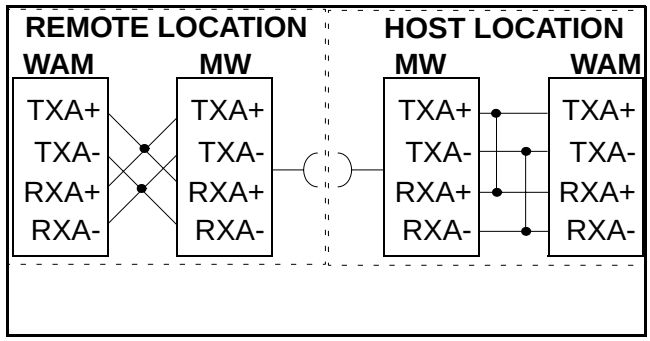


Figure 19-8 WAM AUDIO CABLE LAYOUT TWO LOCATIONS

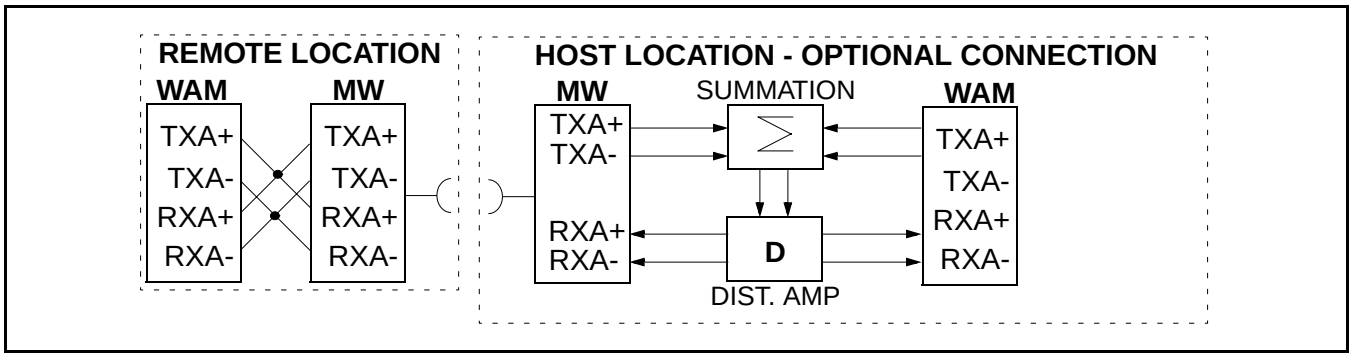


Figure 19-9 AUDIO CABLE LAYOUT TWO LOCATIONS WITH EXTERNAL AUDIO DEVICE

A Location where at least two external interfaces are used for connection from the Host Location to the Remote Locations (as in Figure 19-5) is shown in Figure 19-10. If more than two external interfaces are required then the summation and distribution amps must have the appropriate number of inputs and outputs. The summation and/or distribution amplifiers may be ganged together if needed.

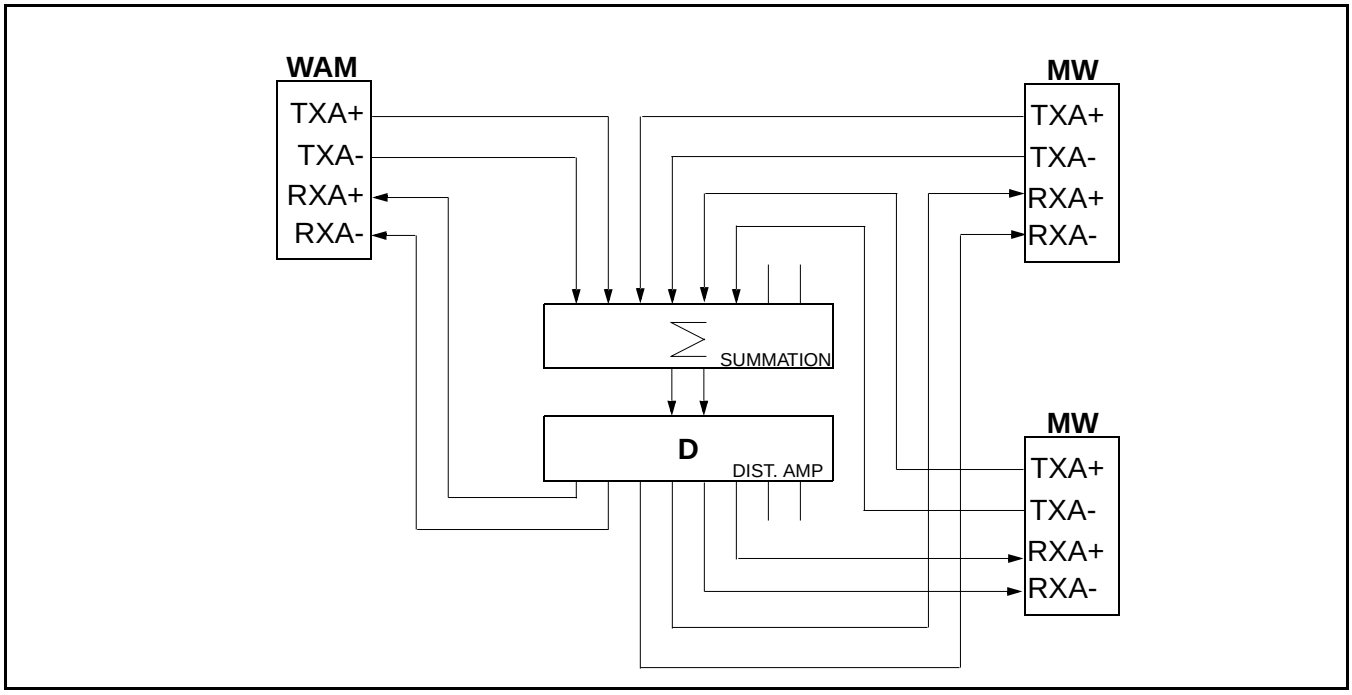


Figure 19-10 AUDIO CABLE LAYOUT HOST LOCATION OF A 3 LOCATION CONFIGURATION

This page intentionally left blank.

SECTION 20 MULTI-NET CONSOLE MODULE (MCM)

20.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 8-1 for the Basic Board block diagram. The Multi-Net Console Module (MCM) interfaces to a VRCM-50 series dispatch console.

The MCM has a digital data connection that requires a separate full duplex 9600 baud RS-232 interface called the Intelligent Dispatch Interface Bus (IDIB). The separate data path is required to allow the computer controlled dispatch console(s) to monitor and display the status of other groups. This status and display update can take place while the console is busy with voice communication on another group. The information exchanged between the MCM and the console(s) controls what the MCM receives and transmits for voice communication.

The MCM connects the 4-wire, 600-ohm balanced audio with the Pulse Code Modulation (PCM) data paths and communicates to other modules via the Intra-Terminal Data Bus (IDB). The MCM also monitors the Channel Status Bus (CSB) to send update changes to the console via the IDIB.

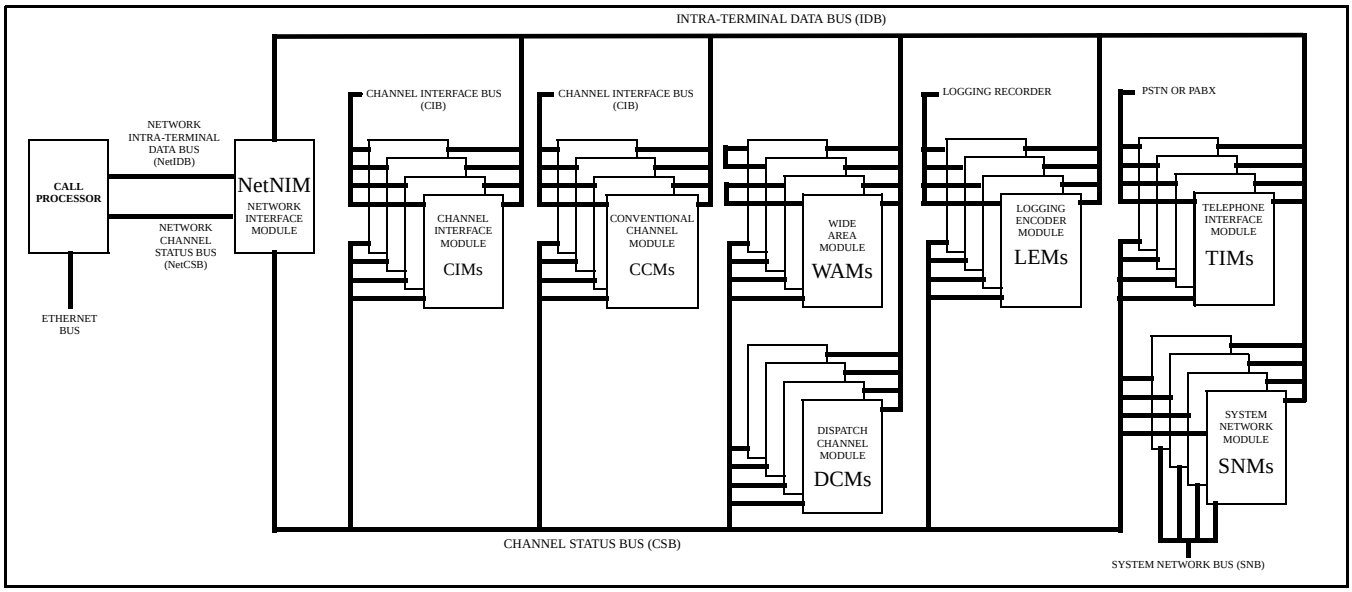


Figure 20-1 DATA BUS BLOCK DIAGRAM

20.2 MCM SETUP PROCEDURE

20.2.1 SWITCH SETTINGS

Refer to Figure 20-2 for Alignment Points Diagram.

Command and Control Communication

The command and control communication to the Consoles takes place on a digital RS-232 link at 9600 baud. The digital link occurs on the Secondary lines.

Table 20-1 MCM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	2	-	4	-	-	3	-
S3	1	2	-	-	-	-	3	4
S4	-	-	3	4	1	2	-	-
S5	-	-	-	-	1	2	3	4

20.2.2 MCM JUMPER PLACEMENT

Table 20-2 MCM JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not used Normal audio
P33	1 to 2* 3 to 4* 5 6	No personality card attached No personality card attached open open
J36	1 only* 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
*Setting for Normal operation.		

20.2.3 MCM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

Table 20-3 BACKPLANE PINOUTS

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	Signal
pin 28	Sec Rx -	pin 2	Ground
pin 29	EA lead	pin 3	
pin 30	EB lead	pin 4	
pin 31	Pri Rx Audio+	pin 5	RX+
pin 32	Pri Rx Audio-	pin 6	RX-
		J2,4,6,8	
pin 59	Sec Tx +	Signal	pin 1
pin 60	Sec Tx -	Ground	pin 2
pin 61	MA lead	Unsel Tx+	pin 3
pin 62	MB lead	Unsel Tx-	pin 4
pin 63	Pri Tx Audio+	Select Tx+	pin 5
pin 64	Pri Tx Audio-	Select Tx-	pin 6

20.3 MCM ALIGNMENT SPECIFICATION

20.3.1 PRE-ALIGNMENT

The MCM is pre-aligned with the Basic Board Module alignment procedures, refer to Section 8.3.

1. Main Rx Audio Level From J1.

   a. Setup for alignment, input 1004 Hz tone at -12 dBm into J1 EQU.
   b. Set S5 for Test 1 (open section 1, close 2, 3 and 4).
   c. Reset the module, Press S2 and release.
   d. Adjust R41 to -6 dBm ±0.5 dB at J11.
   e. Verify that the level at TP5 is -6 dBm ±1 dB.

6. Main Tx Audio Output Level From J1.

   a. Setup for alignment as in Step 1.
   b. Adjust R83 for a -3 dBm ±0.5 dB level at TP3.
   c. Adjust R44 for a -12 dBm ±0.5 dB level at J12.

4. Normal Operation

   a. Set S5 to 0, normal operation (close sections 1, 2, 3, and 4).
   b. Reset the module, press S2 and release.
   c. Remove the input alignment tone from J1.

NOTE: FSK is not aligned since it is not used on the MCM.

20.4 ALIGNMENT

Connections to the MCM may take several forms:

- Direct Connection.
- Leased Lines.
- Microwave Link.
- T1 Channel Bank Interfaces.

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.

2. Set S5 to Test 1 (open section 1, close sections 2, 3 and 4).

3. Reset the module, Press S2 and release.

4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.

5. Set S5 for normal operation (all sections closed).

6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm maximum input, set J12 for -28 dBm.

Proceed To Talk Tone Level (Orbicom Consoles)

When using the Multi-Net Console Module with an Orbicom Console, perform the following alignment.

1. Set S5 to Test 1 (open section 1, close sections 2, 3, and 4).

2. Adjust R83 for -3 dBm ±0.5 dB level at TP3.

3. Set S5 to 0, normal operation (close sections 1, 2, 3, and 4).

4. Reset the module, Press S2 and release.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.

2. Set S5 to Test 1 (open section 1, close sections 2, 3, and 4)

3. Reset the module, Press S2 and release.

4. Insert the maximum level determined in Step 1 using a 600-ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.

5. Adjust R41 to be -6 dBm at J11.

6. Set S5 for normal operation (all sections closed).

7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm maximum output, set J11 for -5 dBm.

Secondary Transmit and Receive

Not aligned since the MCM does not use FSK signaling.

20.5 PCM SUMMATION PERSONALITY CARD

The PCM Summation Personality Card sums multiple time slots on the PCM audio bus for the unselect audio for the VRCM-50 Series of consoles (see Figure 20-3).

20.5.1 INTERNAL CONNECTIONS

1. Plug the summation card into J32.

2. Plug the summation card into the piggyback bus via J31.

3. Connect wire harness A3 on the Main Card to the summation card:
   Rx PCM Primary U26, pin 13 to J4, pin 1
   Master Clock U26, pin 9 to J4, pin 2
   Master Sync U26, pin 7 to J4, pin 3

4. Connect wire harness A2 on the Main Card to the Summation Card:
   M-lead relay K1, pin 1 to UNSEL+ J3, pin 1
   M-lead relay K1, pin 4 to UNSEL- J3, pin 2

5. Remove Q12 to ensure the M-lead is inactive.

20.5.2 EXTERNAL CONNECTIONS

The Summed Unselect Audio Output is on the MA and MB external connections.

The Summed Select Audio Output is on the Primary Tx+ and Tx- connections.

20.5.3 ALIGNMENT PROCEDURE

1. Set CIM S5 to Test 9
   (open section 1-4, close 2-3).

2. Unselect audio adjust:

   a. Set MCM S5 to Test 9 (open section 1-4, close 2-3).

   b. Press S2 on the MCM and release.

   c. Adjust R36 for 4.0V P-P ±0.25V at TP1 on the summation card using an oscilloscope. (Alternate method: Use the transmission test set and adjust R36 for -22.0 dBm ±1 dB).

   d. Adjust R37 for -3 dBm at TP2 on the PCM summation Card.

3. Select Audio adjust:

   a. Set MCM S5 to Test 10 (open section 2-4; close 1-3).

   b. Press S2 on the MCM and release.

   c. Adjust R38 for 4.0V P-P ±0.25V at TP3 on the summation card using an oscilloscope. (Alternate method: Use the transmission test set and adjust R38 for -23.0 dBm ±1 dB).

   d. Adjust R39 for -3 dBm at TP4 on the PCM Summation Card.

4. Set S5 on CIM and MCM (all sections closed).

5. Reset each module, press S2 and release.

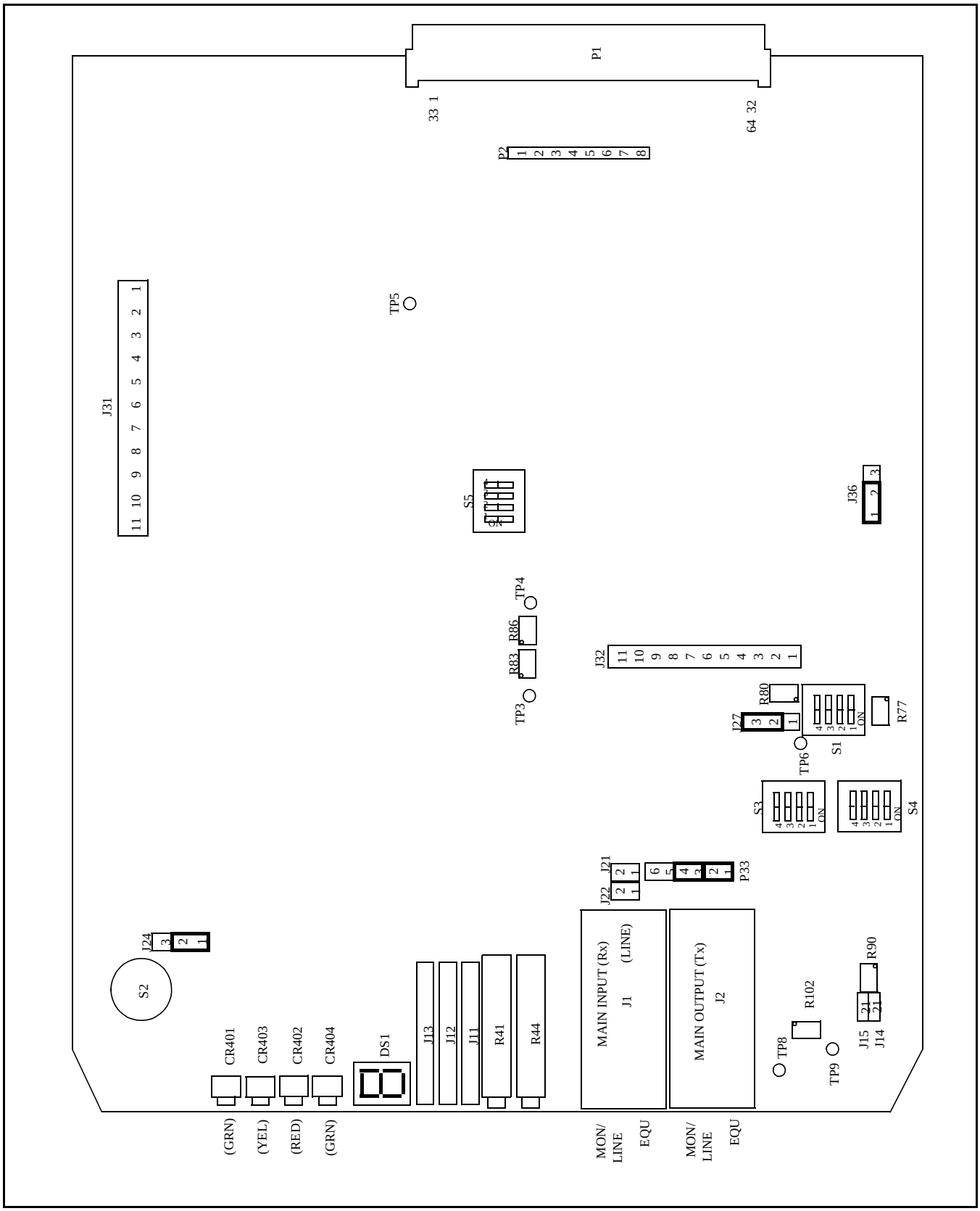


Figure 20-2 ALIGNMENT POINTS DIAGRAM

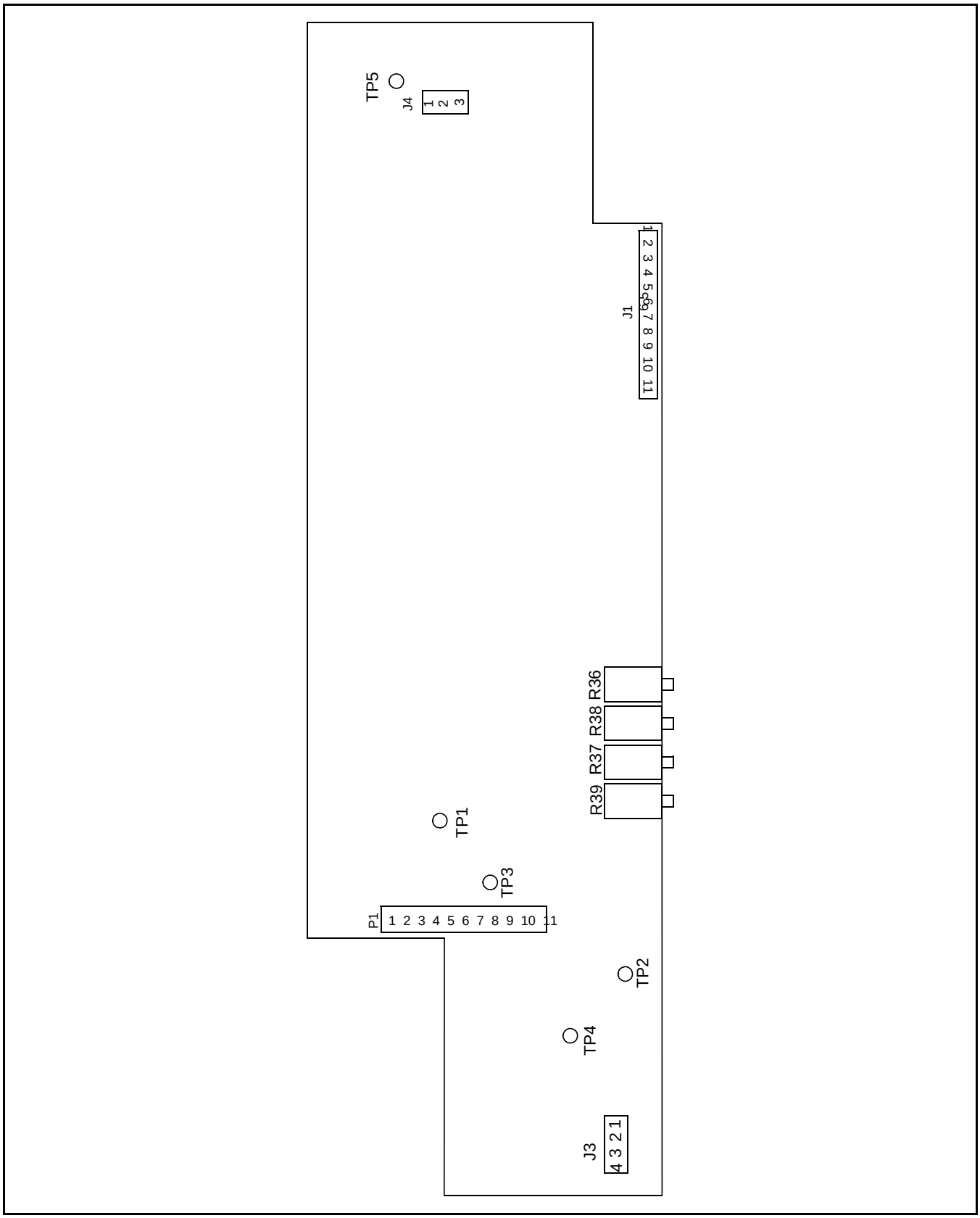


Figure 20-3 SUMMATION BOARD (-760) ALIGNMENT POINTS DIAGRAM

SECTION 21 CONVENTIONAL PATCH MODULE (CPM)

21.1 DESCRIPTION

Refer to 3000 Series Switch Service Information manual, Part No. 001-3139-102, for the component layout, parts list and schematic. Refer to Figure 8-1 for the Basic Board Block diagram.

The Conventional Patch Module (CPM) is used to dynamically patch a single conventional channel to a single trunked group. The Switch can hold two CPMs per MCM. The CPMs must be adjacent to the controlling MCM (e.g. the MCM is at Slot 8005 so the CPMs must be placed in Slots 8006 and 8007). No other cards may be placed in these slots. If the user wishes to patch a conventional channel to more than one trunk group the following procedure must be used.

1. A trunk group is chosen for the CPM patch, (e.g. Site 1, Home 1, Group 1 (S1H1G1) and the conventional channel is chosen or vice versa.

2. The trunk group chosen for the CPM patch (S1H1G1) must be placed in a group patch with the other trunk groups for the patch in a Wide Area Module (WAM) patch.

A CPM with direct connection is associated with only one group code and uses a form of Type II E&M lead input similar to the mobile PTT.

The CPM connect the 4-Wire 600 ohm balanced audio with the Pulse Code Modulation (PCM) data paths and communicates to other modules via the Intra-Terminal Data Bus (IDB). The CPM also monitors the Channel Interface Module (CIM) Channel Status Bus (CSB) to determine if a CIM is active with a CPM group.

21.2 PCM SETUP PROCEDURE

21.2.1 SWITCH SETTINGS

Refer to Figure 21-1 for Alignment Points diagram.

Command and Control Communication

The command and control communication to the Consoles may takes place by direct contact with E&M input and output.

Table 21-1 CPM SWITCH SETTINGS

Switch	Open Sections				Close Sections			
S1	1	2	-	4	-	-	3	-
S3	1	2	3	4	-	-	-	-
S4	1	2	3	4	-	-	-	-
S5	-	-	-	-	1	2	3	4

21.2.2 CPM JUMPER PLACEMENT

Table 21-2 CPM BOARD JUMPER PLACEMENT

JU	Pin	Description
J24	1 to 2* 2 to 3	Selects 27512 EPROM operation Selects 27256 EPROM operation
J27	1 to 2 2 to 3*	Not Used Normal Operation
P33	1 to 2* 3 to 4* 5 6	No personality card attached No personality card attached open open
J36	1 only* 1 to 2 2 to 3	Not used -48V E-lead operation -15V E-lead operation
J14 J15 J21 J22	Jumper pin 1 to 2 for high impedance ground path for split 600 ohm inputs and outputs. Leave open if no ground path desired.	
*Setting for Normal operation.		

Table 21-3 BACKPLANE PLACEMENT

Backplane P34 to P45	Description	Wire Harness J1,3,5,7	
pin 27	Sec Rx +	pin 1	Signal
pin 28	Sec Rx -	pin 2	Ground
pin 29	EA lead	pin 3	
pin 30	EB lead	pin 4	
pin 31	Pri Rx Audio+	pin 5	RX+
pin 32	Pri Rx Audio-	pin 6	RX-
		J2,4,6,8	
pin 59	Sec Tx +	Signal	pin 1
pin 60	Sec Tx -	Ground	pin 2
pin 61	MA lead		pin 3
pin 62	MB lead		pin 4
pin 63	Pri Tx Audio+	Tx+	pin 5
pin 64	Pri Tx Audio-	Tx-	pin 6

21.2.3 E-LEAD SELECTION

If the PTT from the console is an open contact relay, either of the above options for J36 may be used.

If the PTT is a closure to ground with a pull-up resistor to a positive voltage, J36, pin 2 should be connected to ground without connection to pin 1 or pin 3.

21.2.4 CPM BACKPLANE EXTERNAL CONTACTS

See the Backplane Section 23 for pinouts on the shelf backplane and wire harness pinouts.

21.3 CPM ALIGNMENT SPECIFICATION

21.3.1 PRE-ALIGNMENT

The CPM is pre-aligned with the Basic Board Module alignment procedures (Refer to Section 8.3).

21.3.2 ALIGNMENT

Connections to the CPM may take several forms:

1. Direct Connection
2. Leased Lines
3. Microwave Link
4. T1 Channel Bank Interfaces

This ancillary equipment requires certain input and output levels for proper operation. The module should be adjusted accordingly.

Main Transmit

1. Determine the maximum level to be received by the ancillary equipment to be transmitted.
2. Set S5 to Test 1 (open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Adjust R44 for -12 dB from the maximum level in Step 1 at J12.
5. Set S5 for normal operation (all sections closed).
6. Reset the module, Press S2 and release.

   Example: Microwave has -16 dBm max input, set J12 for -28 dBm.

Main Receive

1. Determine the maximum transmit level that is sent by the ancillary equipment to the interface module.
2. Set S5 to Test 1 (open section 1, close sections 2, 3 and 4).
3. Reset the module, Press S2 and release.
4. Insert the maximum level determined in Step 1 using a 600 ohm audio oscillator into EQU port of J1. Otherwise, set the ancillary equipment to send the alignment tone to the interface module.
5. Adjust R41 to be -6 dBm at J11.
6. Set S5 for normal operation (all sections closed).
7. Reset the module, Press S2 and release.

   Example: Microwave has +7 dBm maximum output, set J11 for -5 dBm.

Secondary Transmit and Receive

Not aligned since the CPM does not use FSK signaling.

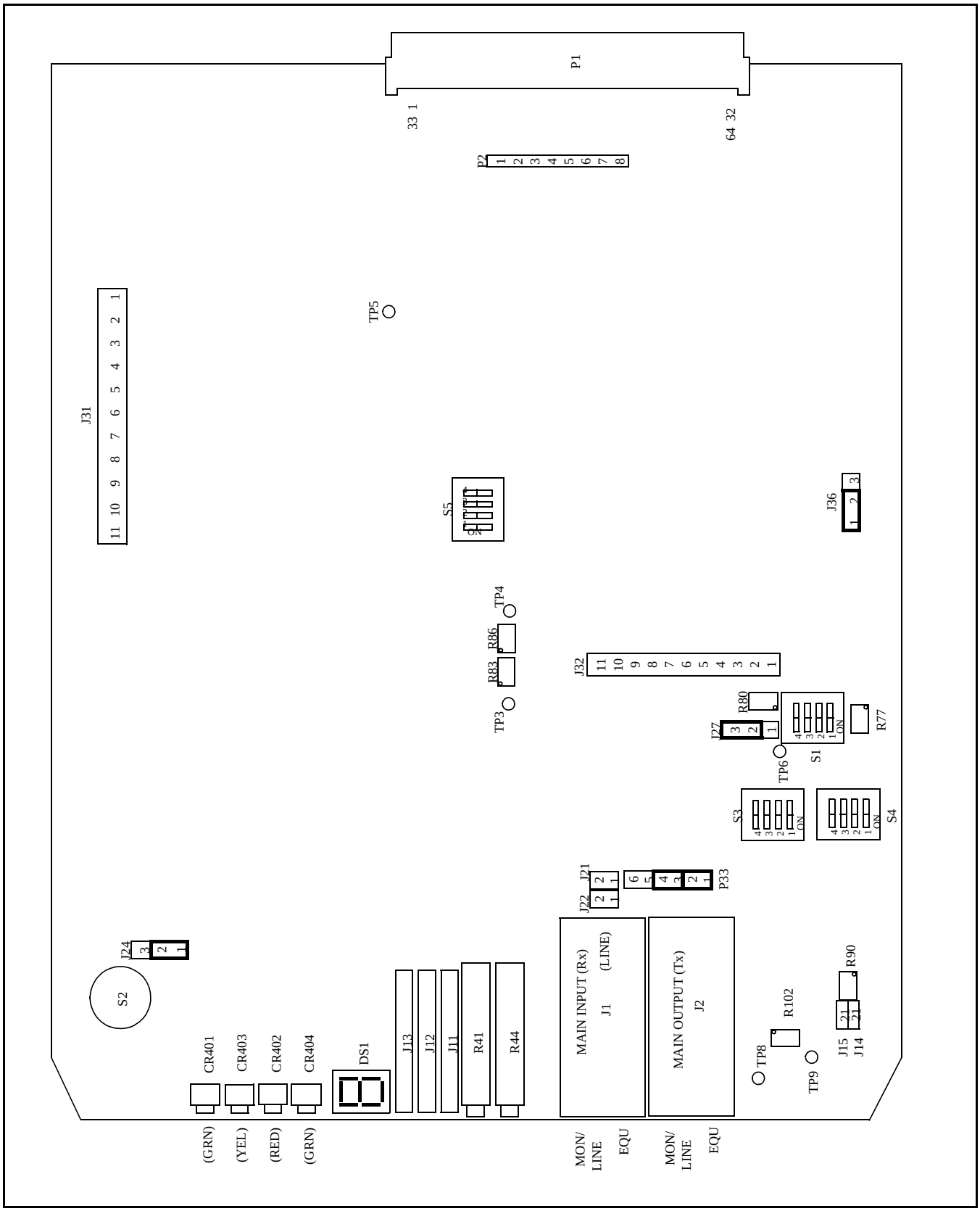


Figure 21-1 CPM ALIGNMENT POINTS DIAGRAM

This page intentionally left blank.

SECTION 22 POWER SUPPLY

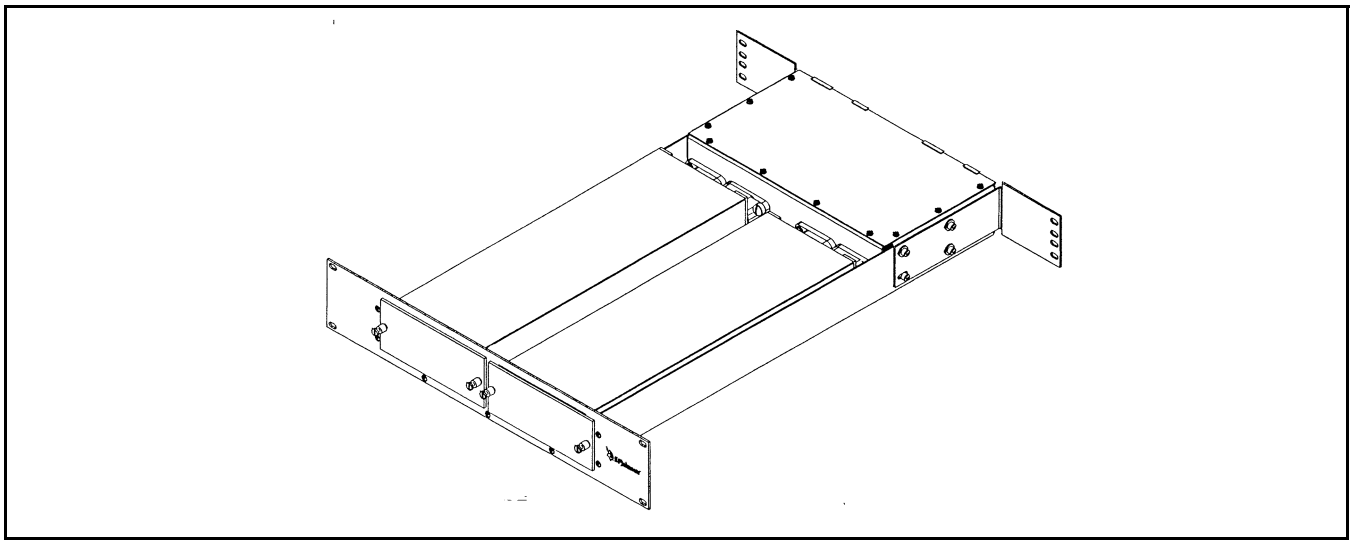


Figure 22-1 POWER SUPPLY

22.1 INTRODUCTION

The Switch may be powered by different types of power e.g.:

- 110V AC Single Phase
- 230V AC Single Phase

A power supply may be removed and installed while power is applied to the Switch provided the Switch is equipped with a Redundant Supply.

See Section 4 for a wiring diagram of the power supplies.

22.2 POWER CONSUMPTION

The following tables shows the voltage, current and power for each supply voltage per card (based on loading of 72 cards).

Total watts including TIM-DID is 5.74W. Excluding the TIM-DID provides a total of 4.3W for normal modules. The following formulas are used to find the BTUs per hour.

The total wattage of the terminal is found by multiplying the wattage of a module by the number of modules.

Total Watts x No. of Modules = Terminal Power

The wattage required by the power supply is found by dividing the total wattage of the terminal by the efficiency of the power supply (0.7).

Terminal Power ÷ 0.7 = Wattage of Power Supply

The BTUs per hour are found by multiplying a known value (3.6) by the wattage required by the power supply.

3.6 x Wattage of Power Supply = BTU per hour

EXAMPLE:

4.3W x 72 = 310W
310W ÷ 0.7 = 443W
3.6 x 443W = 1,595 Btu/Hr

Table 22-1 AVERAGE VOLTAGE/CURRENT/ POWER

Voltage	Current	Power
+5V DC	0.50A	2.50W
+12V DC	0.10A	1.20W
-12V DC	0.05A	0.60W
-48V DC	0.03A*	1.44W
	Total	5.74W
* DIDs only.		

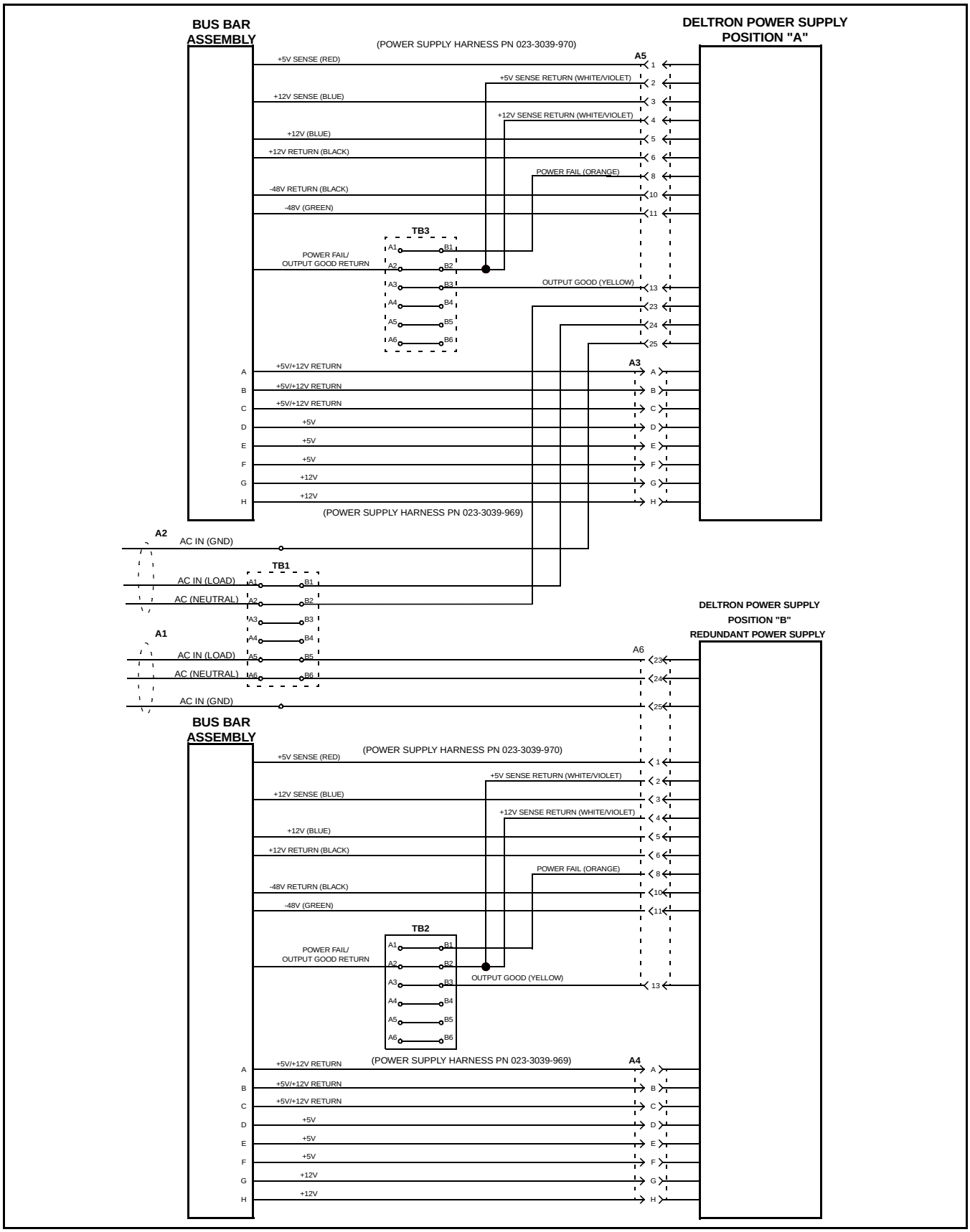


Figure 22-2 6-8 SHELF POWER SUPPLY INTERCONNECT DIAGRAM

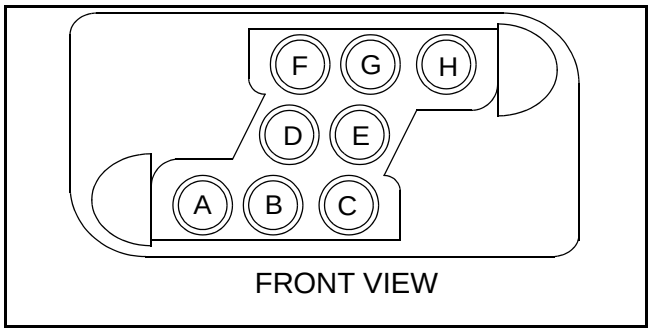


Figure 22-3 A3-A4 CONNECTOR

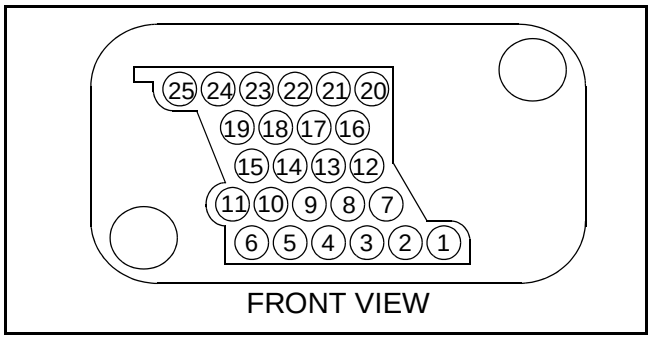


Figure 22-4 A5-A6 CONNECTOR

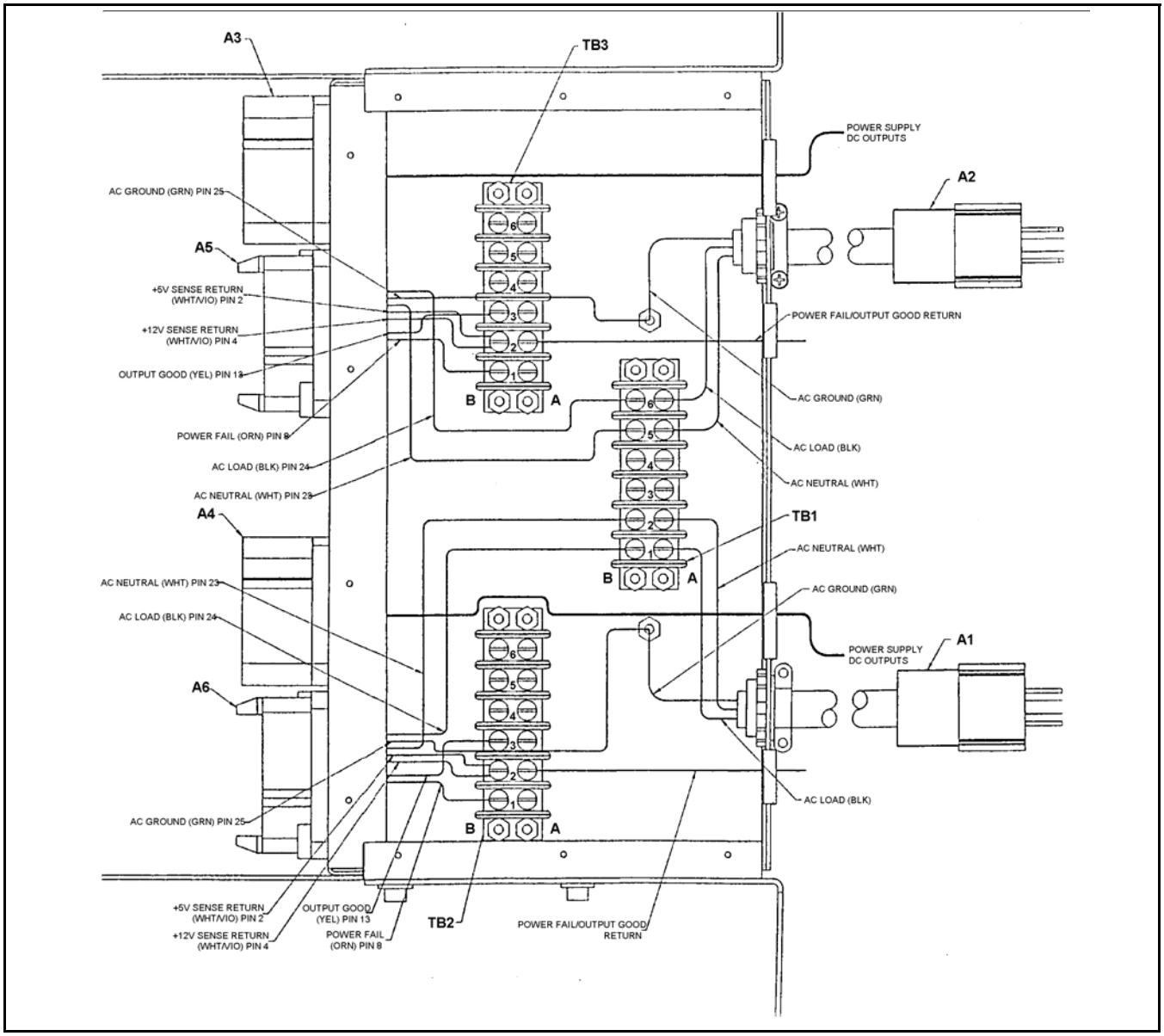


Figure 22-5 POWER SUPPLY TERMINAL BLOCKS

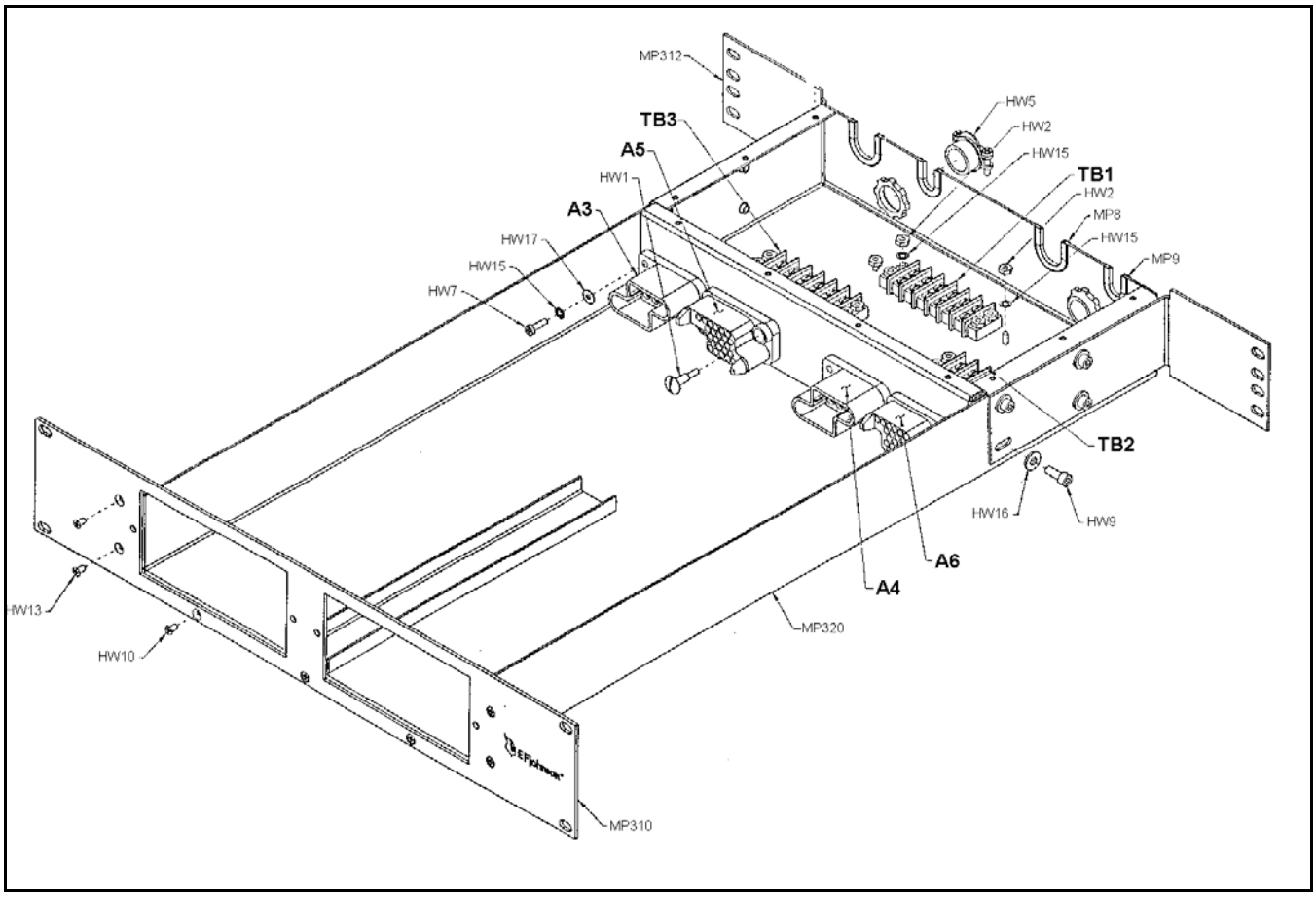


Figure 22-6 POWER SUPPLY DRAWER

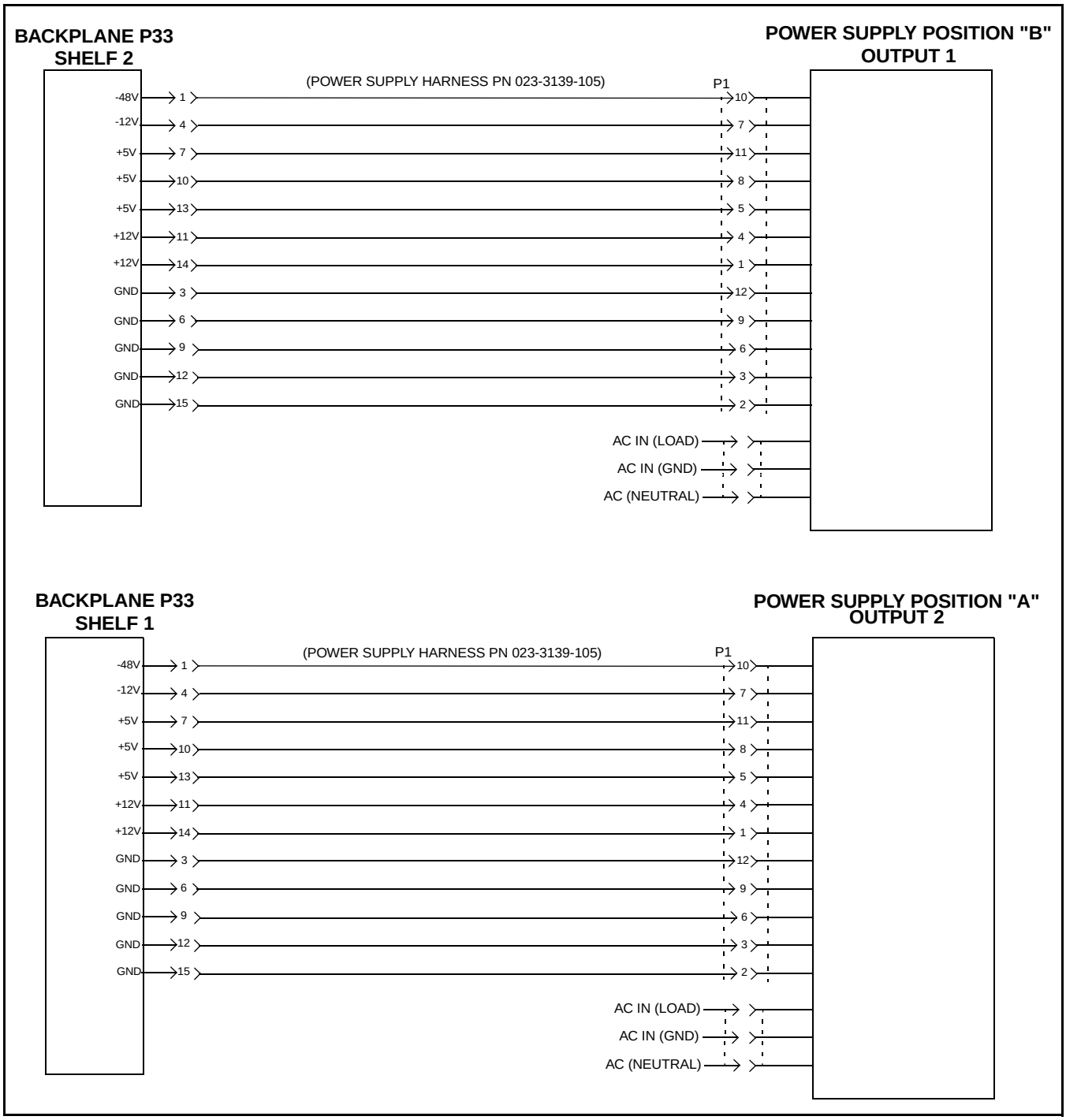


Figure 22-7 2-4 SHELF POWER SUPPLY INTERCONNECT

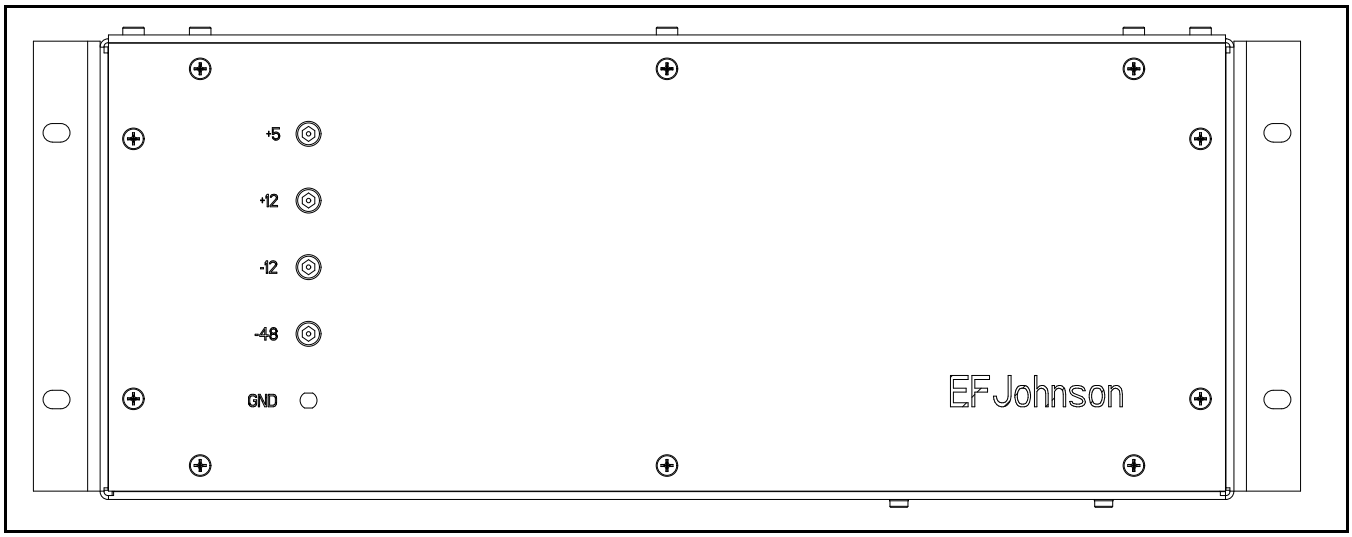


Figure 22-8 2-4 SHELF POWER SUPPLY (FRONT VIEW)

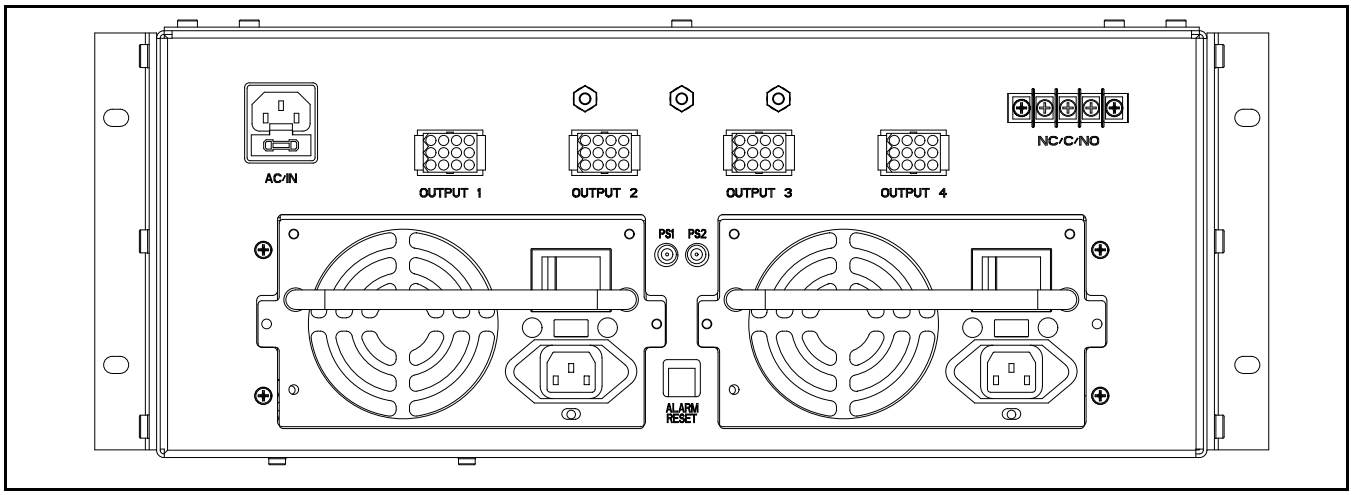
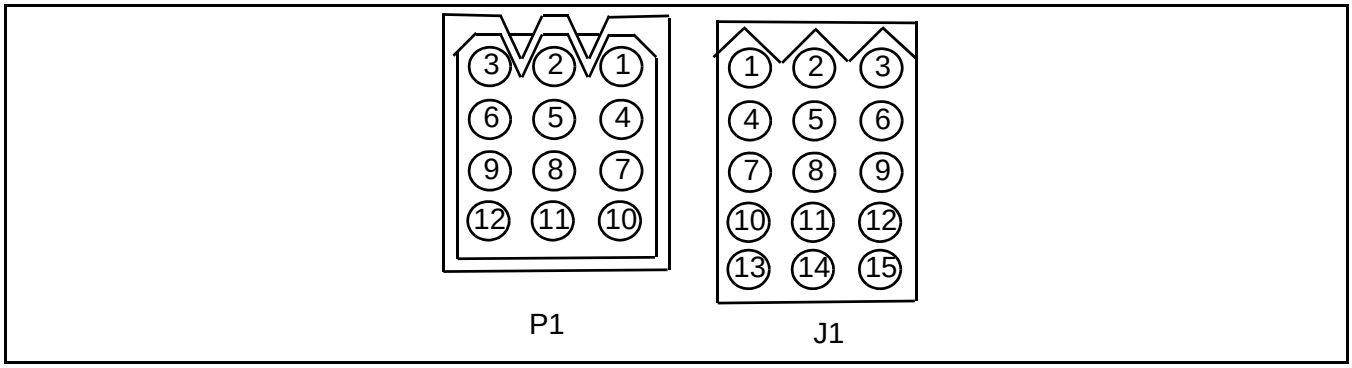


Figure 22-9 2-4 SHELF POWER SUPPLY (REAR VIEW)



SECTION 23 BACKPLANE

23.1 DESCRIPTION

The 3000 Series Switch shelf backplane contains slots that modules are inserted into, to derive the module address. The backplane distributes:

- Power
- PCM paths
- Master clock
- Master sync
- Intra-Terminal data bus
- Channel status bus
- Control lines for data busses

The backplane has active circuitry that distributes PCM paths, master clock and master sync. The backplanes are connected together for complete distribution of receive and transmit signals to all shelves within the Switch.

23.2 BACKPLANE SETUP PROCEDURE

23.2.1 SHELF ADDRESS SETTINGS

Using the following table, determine the settings of Switch 1 for the Shelf Address of each shelf.

Table 23-1 SHELF ADDRESS SETTINGS

Shelf Number	Switch 1, Open Sections
1	ALL Closed
2	1
3	2
4	1,2
5	3
6	1,3
7	2,3
8	1,2,3
9	4
10	1,4
11	2,4
12	1,2,4
13	3,4
14	1,3,4
15	2,3,4
16	1,2,3,4
17	5
18	1,5

23.2.2 TERMINATION SETTINGS

Using the following table, determine the switch settings for switches 2 through 8. All switches are 37.5 ohms and normally set for 6 shelves.

- S2 - VTM PCM
- S3 - Primary Tx PCM
- S4 - Primary Rx PCM
- S5 - Master Sync
- S6 - Master Clock
- S7 - Secondary Rx PCM
- S8 - Secondary Tx PCM

Table 23-2 TERMINATION SETTINGS

Number of Shelves	Switch Sections CLOSED
2	ALL
3	1,3,6,7,8
4	1
5	2,4,5,6,7,8
6	2,5,6,7,8
7	2,7
8	3,4,5,6,8
9	3,4,6,7
10	3,4,8
11	3,5,6
12	3,5
13	3,6,8
14	3,7
15	3
16	4,5,6,7,8
17	4,5,6,7
18	4,5,6

23.2.3 JUMPER DEFINITIONS AND SETTINGS

1. External Cable Connections
   - J1/J2 - Shelf Interconnect

2. Primary Audio Connections
   - J3/J5 - Primary Rx PCM
   - J2/J4 - Primary Tx PCM

3. Secondary Audio Connections
   - J23/J25 - Secondary Rx PCM
   - J24/J26 - Secondary Tx PCM

23.3 STANDARD SHELF I/O CONNECTIONS

Refer to the card (CIM or DIM) installed in the standard shelf for further jumper settings. The normal jumper connection is shown in parenthesis.

1. J7 (pin 2 to pin 3)
   - Pin 1 - Output
   - Pin 2 - VTM
   - Pin 3 - Input

2. J8 (pin 2 to pin 3)
   - Pin 1 - Output
   - Pin 2 - VTM PCM (destination)
   - Pin 3 - Input

3. J9-J10
   - J9, pin 3 to J10, pin 3
   - J9, pin 4 to J10, pin 4

4. J11 (pin 2 to pin 3)
   - Pin 1 - Output
   - Pin 2 - Master Sync Shelf (destination)
   - Pin 3 - Input

5. J12 (pin 2 to pin 3)
   - Pin 1 - Output
   - Pin 2 - Master Sync connector
   - Pin 3 - Input

6. J13 (pin 2 to pin 3)
   - Pin 1 - Output
   - Pin 2 - Master Clock Shelf (destination)
   - Pin 3 - Input

7. J14 (pin 2 to pin 3)
   - Pin 1 - Output
   - Pin 2 - Master Clock
   - Pin 3 - Input

8. J15-J16
   - J15, pin 2 to J16, pin 2

9. J17-J18
   - J17, pin 3 to J18, pin 3
   - J17, pin 4 to J18, pin 4

See Figure 23-2 for switch settings.

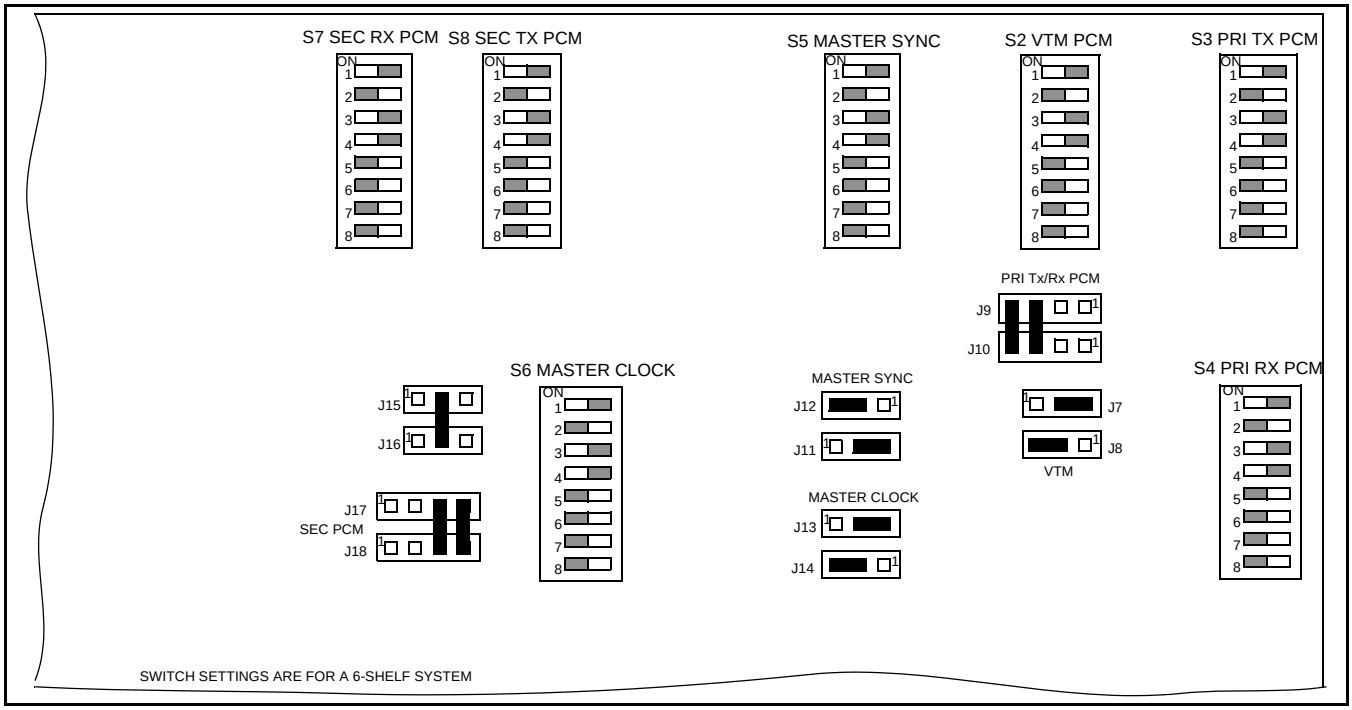


Figure 23-1 STANDARD SHELF BACKPLANE SWITCH AND JUMPER SETTINGS

23.4 CIM SHELF I/O CONNECTIONS

23.4.1 PRIMARY PCM

The normal jumper connection is shown in parenthesis.

1. J9 (pin 1 to J10, pin 1/pin 2 to J10, pin 2)
   - Pin 1 - Input
   - Pin 2 - Output
   - Pin 3 - Input
   - Pin 4 - Output

2. J10 (pin 1 to J9, pin 1/pin 2 to J9, pin 2)
   - Pin 1 - Primary Tx PCM
   - Pin 2 - Primary Rx PCM
   - Pin 3 - Primary Rx PCM
   - Pin 4 - Primary Tx PCM

3. J15 (pin 2 to J16, pin 2)
   - Pin 1 - Input
   - Pin 2 - Input
   - Pin 3 - Input

4. J16 (pin 2 to J15, pin 2)
   - Pin 1 - Output
   - Pin 2 - Input
   - Pin 3 - Output

23.4.2 SECONDARY PCM

The normal jumper connection is shown in parenthesis.

1. J17 (pin 1 to J18, pin 1/pin 2 to J18, pin 2)
   - Pin 1 - Output
   - Pin 2 - Input
   - Pin 3 - Input
   - Pin 4 - Output

2. J18 (pin 1 to J17, pin 1/pin 2 to J17, pin 2)
   - Pin 1 - Output
   - Pin 2 - Input
   - Pin 3 - Input
   - Pin 4 - Output

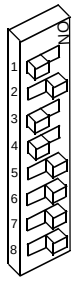


Figure 23-2 S2 - S8 SWITCH SETTINGS

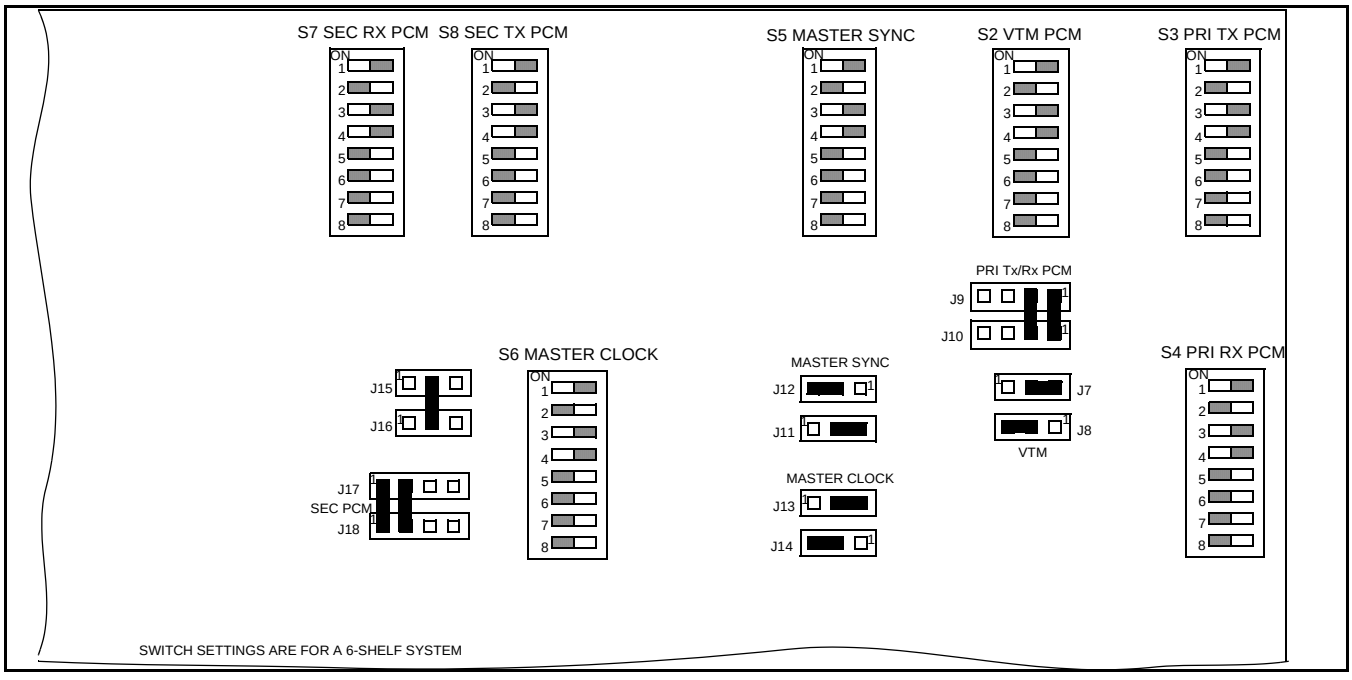


Figure 23-3 CIM/CCM SHELF BACKPLANE SWITCH AND JUMPER SETTINGS

23.5 NetNIM SHELF WITH CIM/CCMs

The following refer to the PCM Receiver/Transmitter. The normal jumper connection is shown in parenthesis. Refer to the card (CIM or DIM) installed in the NetNIM shelf for further jumper settings.

1. J7 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - VTM
   - Pin 3 - Input

2. J8 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - VTM PCM (source)
   - Pin 3 - Input

3. J9 (pin 1 to J10, pin 1/pin 2 to J10, pin 2)
   - Pin 1 - Input
   - Pin 2 - Output
   - Pin 3 - Input
   - Pin 4 - Output

4. J10 (pin 1 to J9, pin 1/pin 2 to J9, pin 2)
   - Pin 1 - Primary Tx PCM
   - Pin 2 - Primary Rx PCM
   - Pin 3 - Primary Rx PCM
   - Pin 4 - Primary Tx PCM

5. J11 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Sync Shelf (source)
   - Pin 3 - Input

6. J12 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Sync connector
   - Pin 3 - Input

7. J13 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Clock Shelf (source)
   - Pin 3 - Input

8. J14 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Clock
   - Pin 3 - Input

9. J15-J16
   - J15, pin 2 to J16, pin 2

10. J17-J18
    - J17, pin 1 to J18, pin 1
    - J17, pin 2 to J18, pin 2

See Figure 23-2 for switch settings.

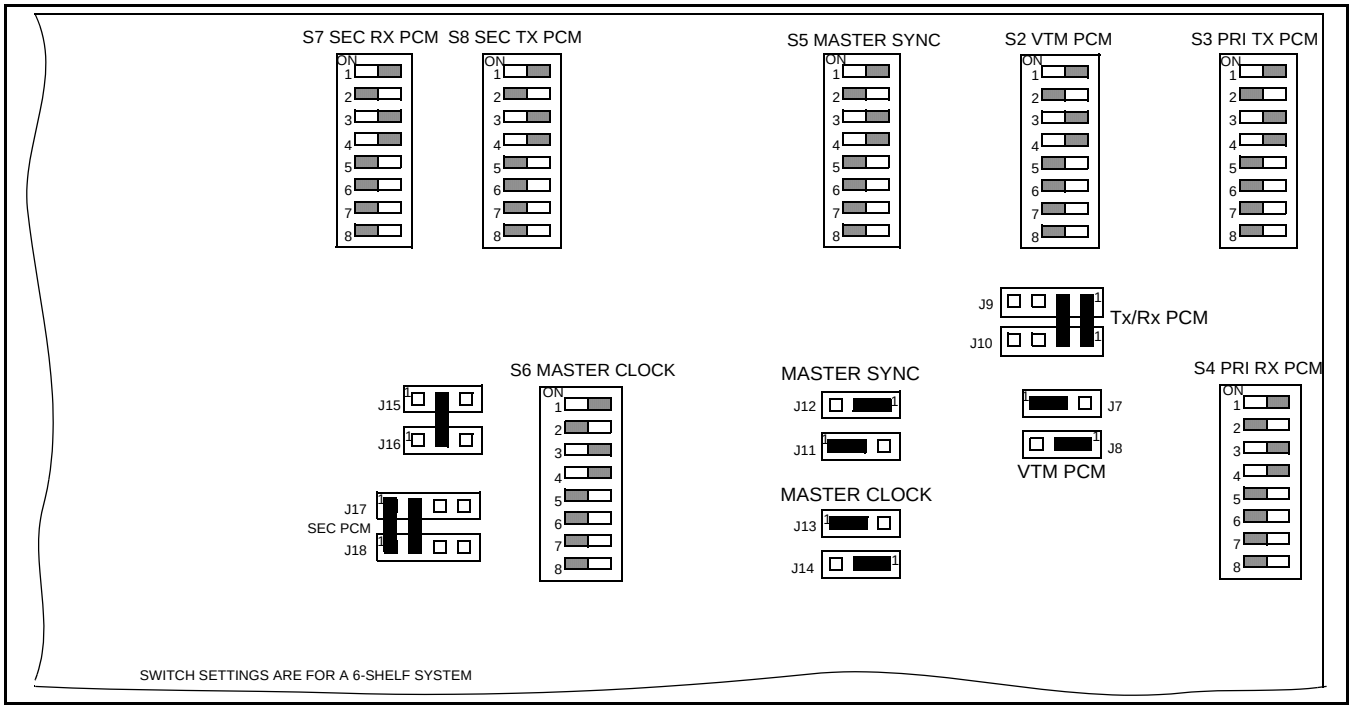


Figure 23-4 NetNIM SHELF WITH CIM/CCMs SWITCH AND JUMPER SETTINGS

23.6 NetNIM SHELF WITHOUT CIM/CCMs

The following refer to the PCM Receiver/Transmitter. The normal jumper connection is shown in parenthesis. Refer to the card (CIM or DIM) installed in the NetNIM shelf for further jumper settings.

1. J7 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - VTM
   - Pin 3 - Input

2. J8 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - VTM PCM (source)
   - Pin 3 - Input

3. J9 (pin 3 to J10, pin 3/pin 4 to J10, pin 4)
   - Pin 1 - Input
   - Pin 2 - Output
   - Pin 3 - Input
   - Pin 4 - Output

4. J10 (pin 3 to J9, pin 3/pin 4 to J9, pin 4)
   - Pin 1 - Primary Tx PCM
   - Pin 2 - Primary Rx PCM
   - Pin 3 - Primary Rx PCM
   - Pin 4 - Primary Tx PCM

5. J11 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Sync Shelf (source)
   - Pin 3 - Input

6. J12 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Sync connector
   - Pin 3 - Input

7. J13 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Clock Shelf (source)
   - Pin 3 - Input

8. J14 (pin 1 to pin 2)
   - Pin 1 - Output
   - Pin 2 - Master Clock
   - Pin 3 - Input

9. J15-J16
   - J15, pin 2 to J16, pin 2

10. J17-J18
    - J17, pin 3 to J18, pin 3
    - J17, pin 4 to J18, pin 4

See Figure 23-2 for switch settings.

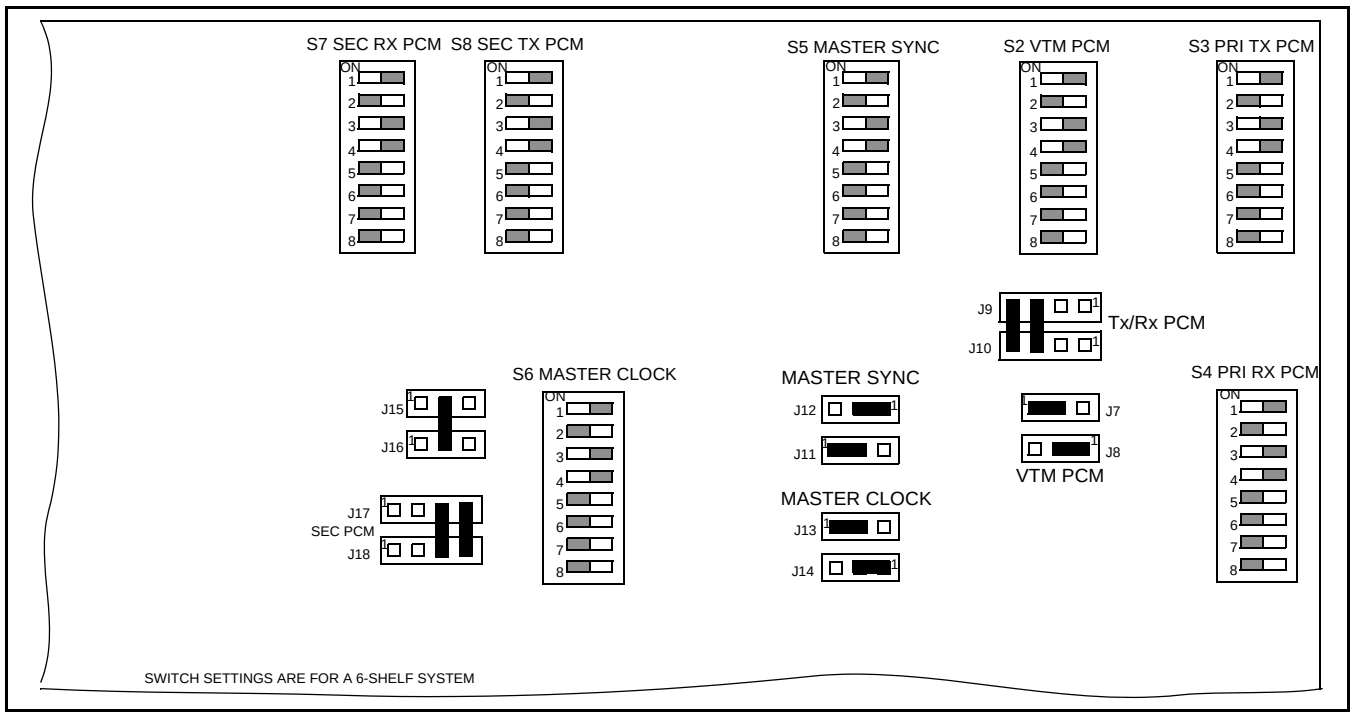


Figure 23-5 NetNIM SHELF WITHOUT CIM/CCMs SWITCH AND JUMPER SETTINGS

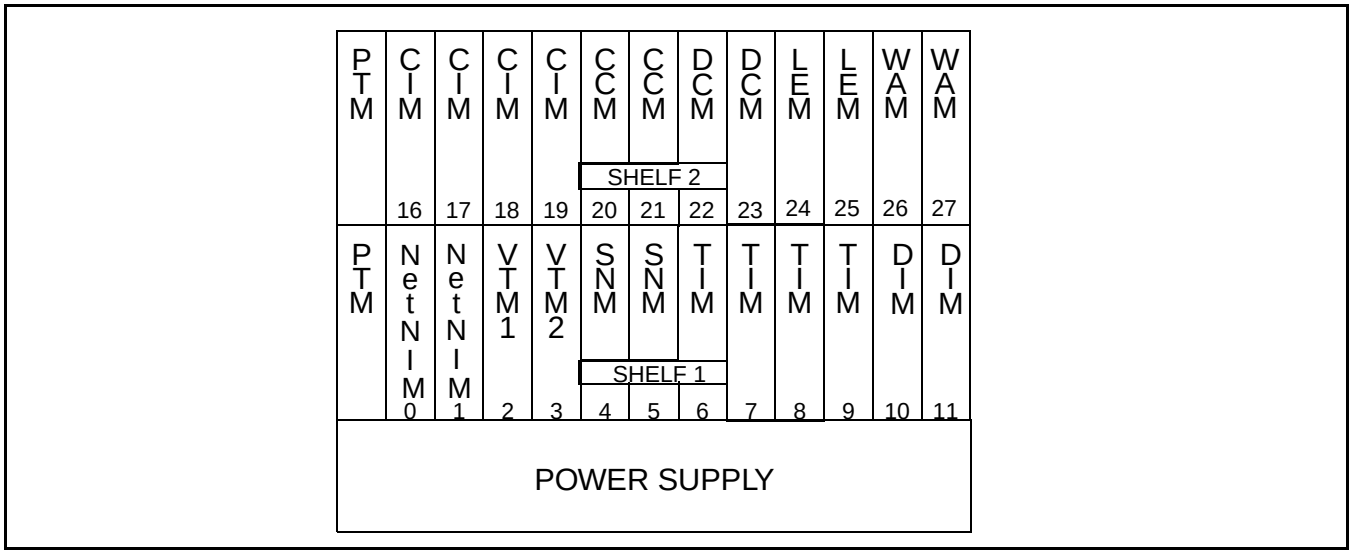


Figure 23-6 2-SHELF 3000 SERIES SWITCH

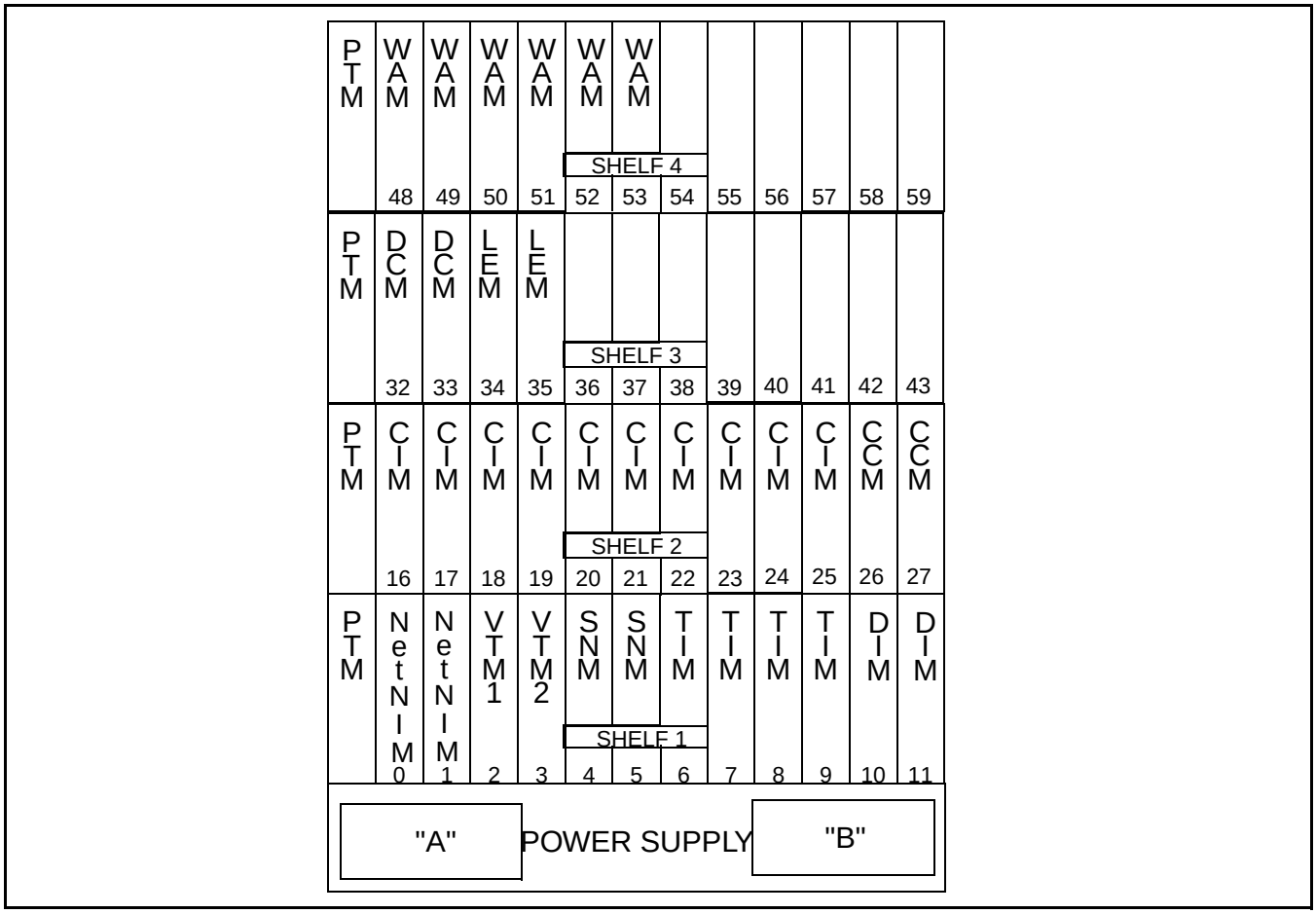


Figure 23-7 4-SHELF 3000 SERIES SWITCH

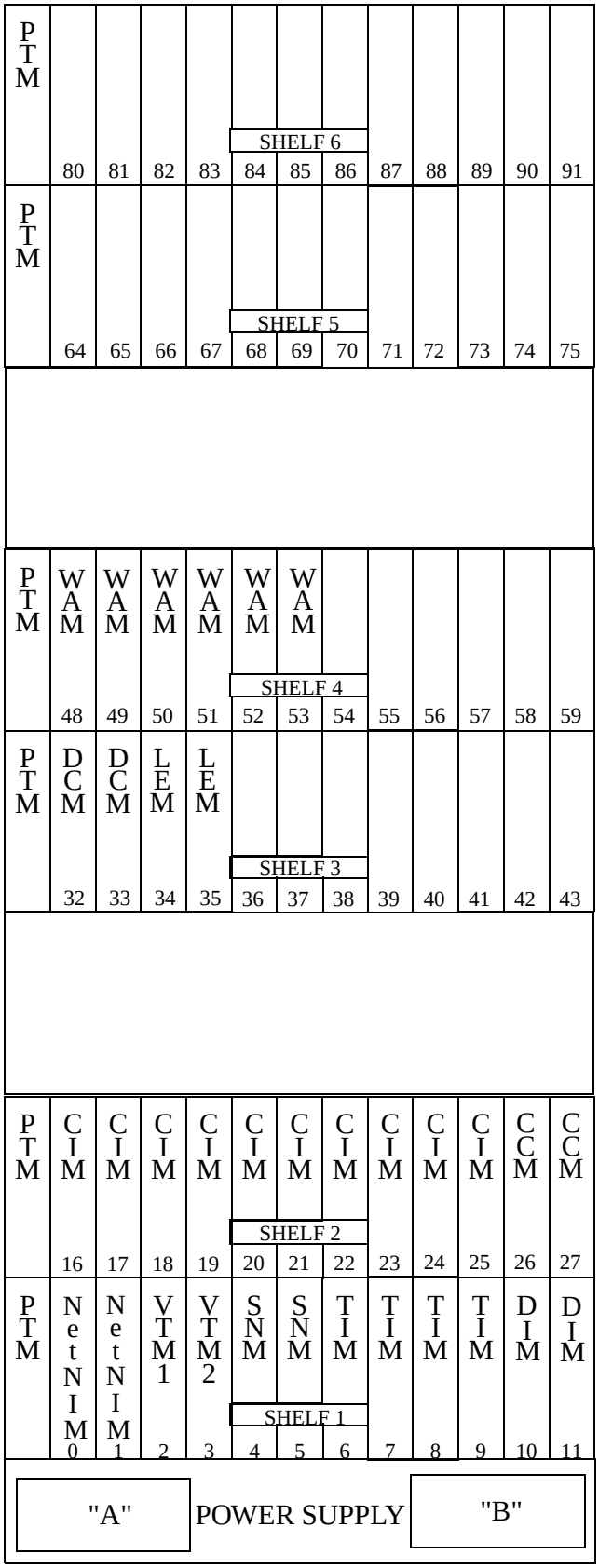


Figure 23-8 6-SHELF SWITCH RACK LAYOUT

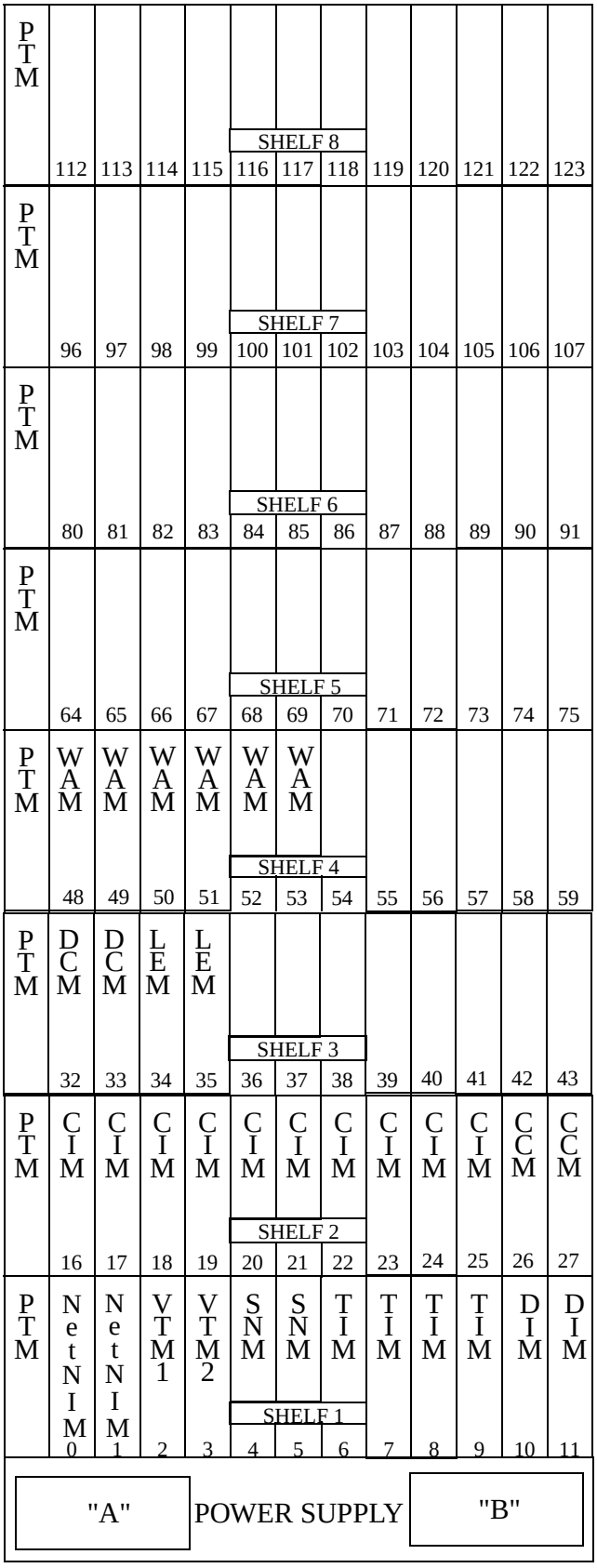


Figure 23-9 8-SHELF SWITCH RACK SETUP

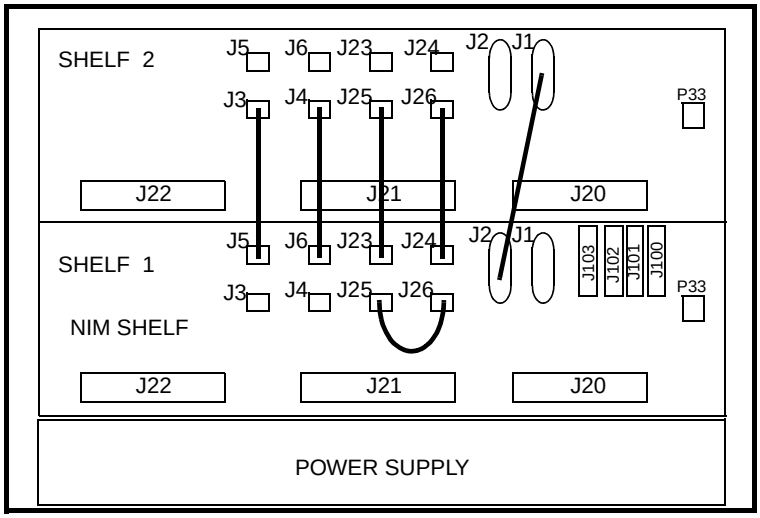


Figure 23-10 2-SHELF SWITCH BACKPLANE CABLES

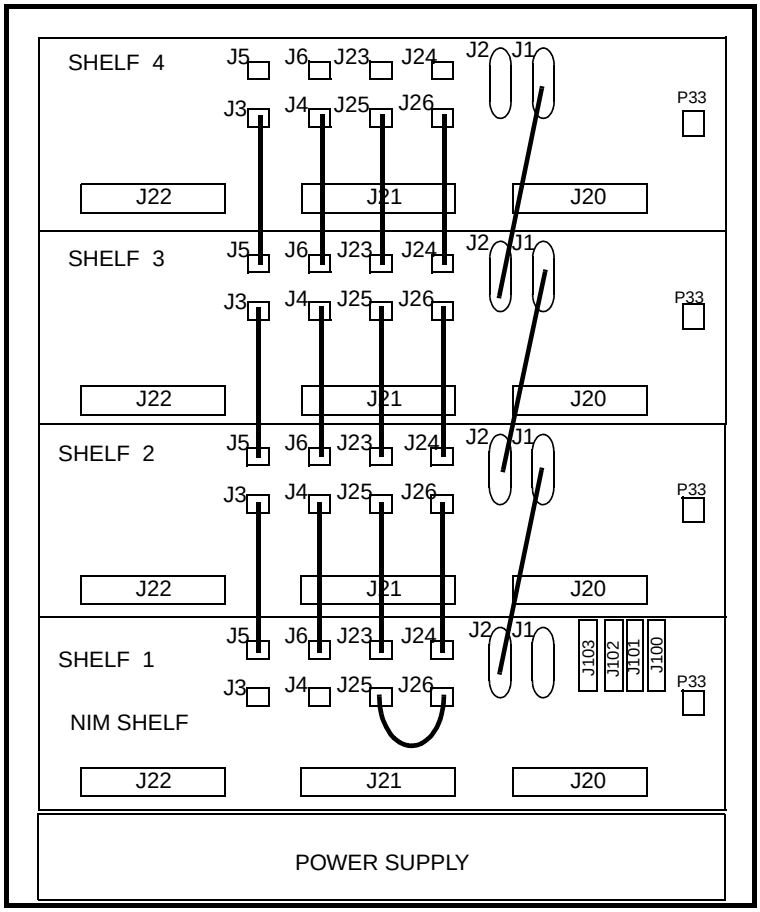


Figure 23-11 4-SHELF SWITCH BACKPLANE CABLES

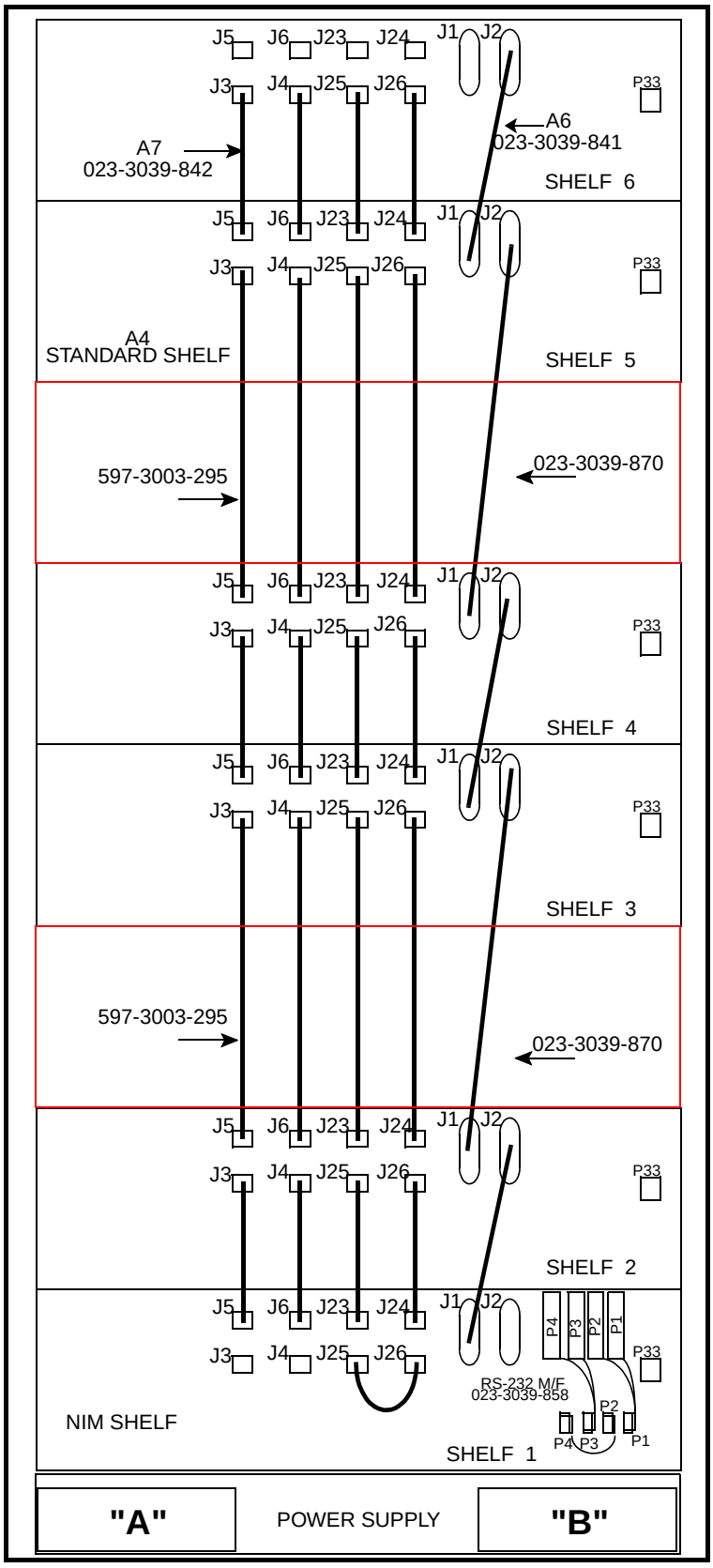


Figure 23-12 6-SHELF SWITCH BACKPLANE CABLES

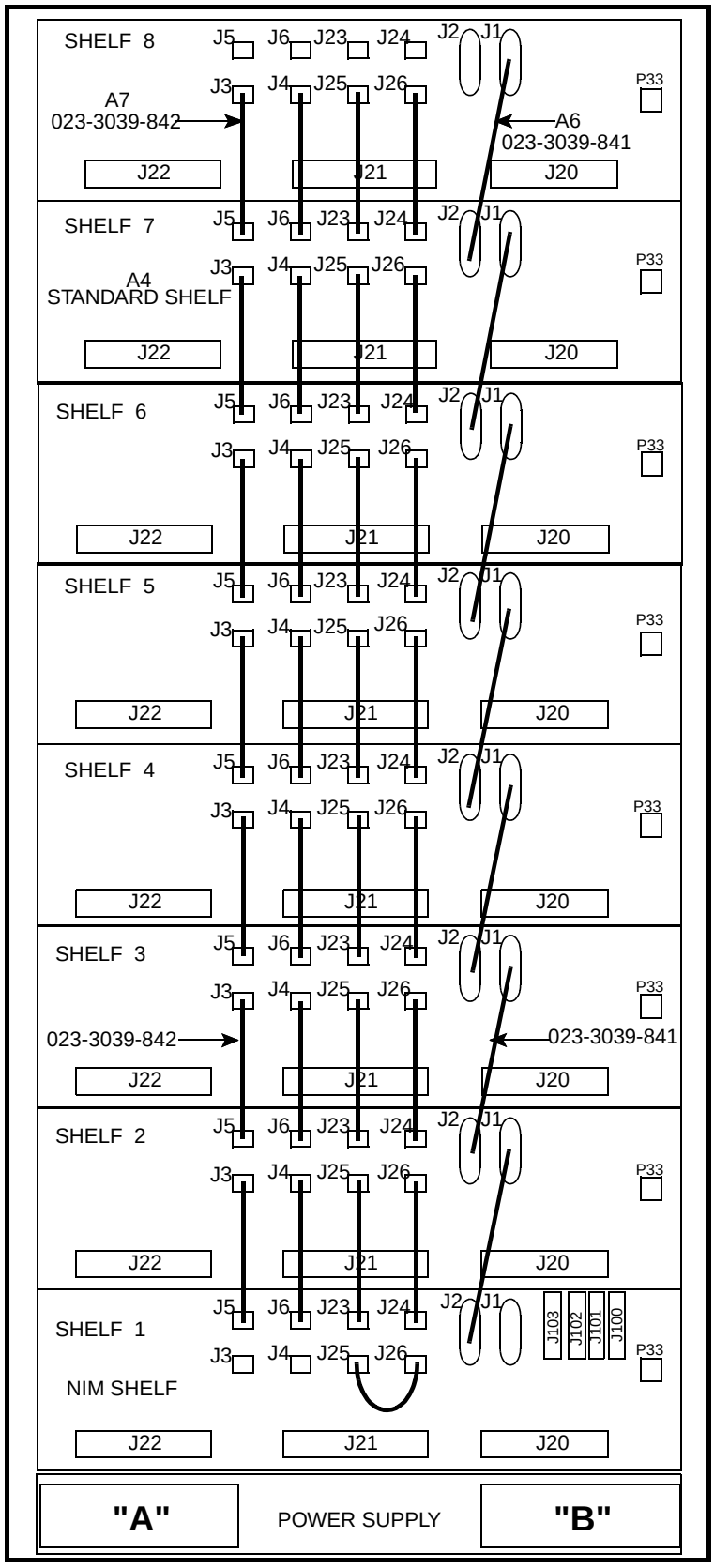


Figure 23-13 8-SHELF SWITCH BACKPLANE CABLES

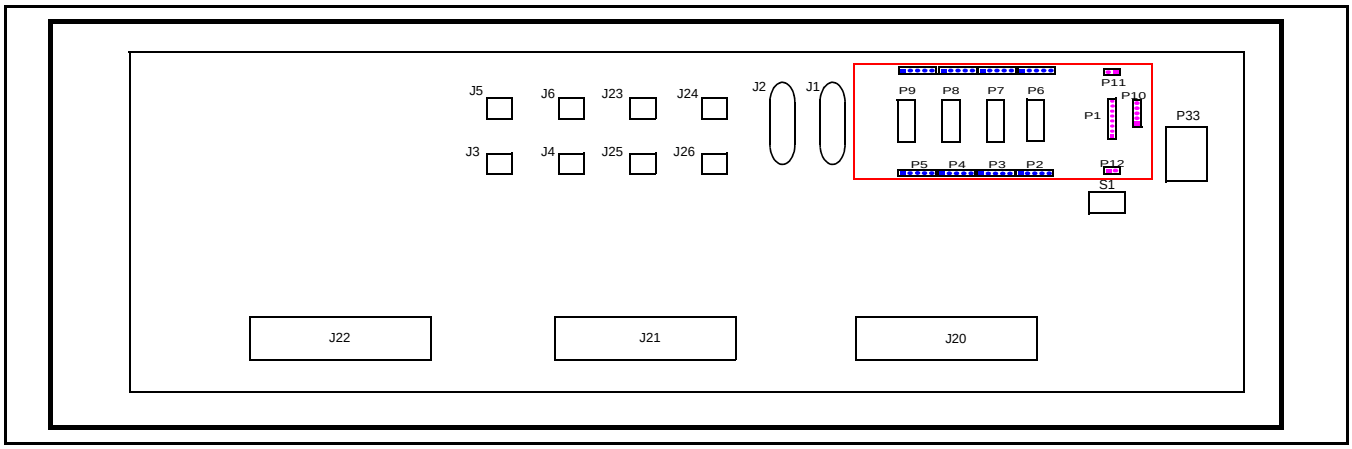


Figure 23-14 BASIC BOARD BACKPLANE WIRING LAYOUT

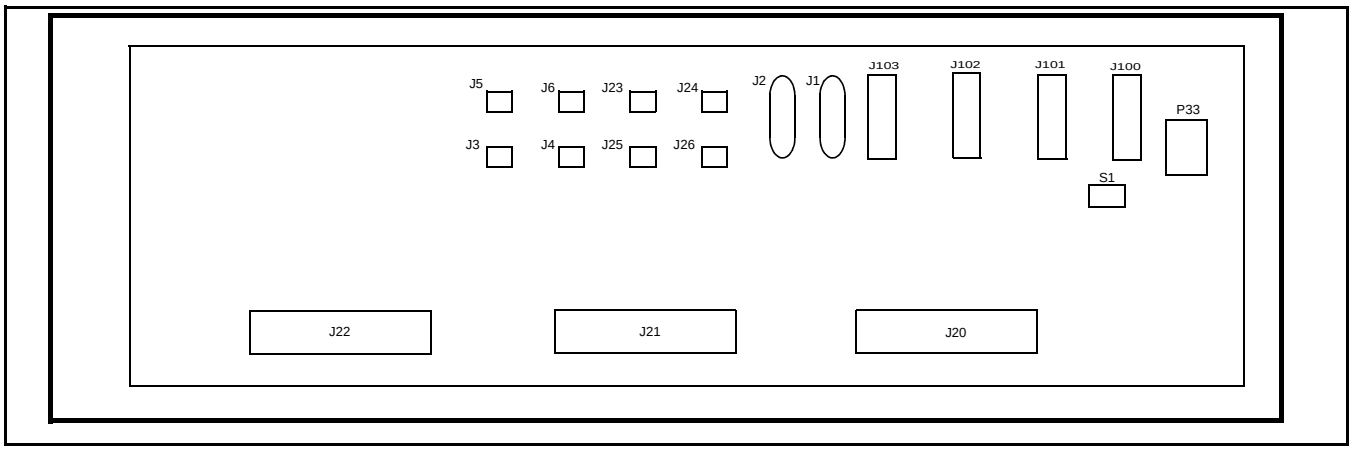
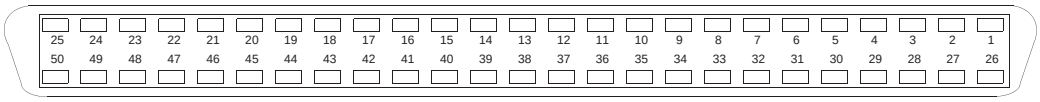


Figure 23-15 NetNIM SHELF BACKPLANE WIRING LAYOUT



1 (RING) AND (TIP) DENOTE TELEPHONE LINE CONNECTIONS TO THE TIM.

2 AUDIO OUTPUT FROM THE CIM SUMMATION BOARDS FOR THE RECORDING SYSTEM ARE THE MA AND MB CONNECITONS.

NOT USED	PIN NUMBERS	
	26	RXS- (WHT/BLU)
	1	RXS+ (BLU/WHT)
	27	TXS- (WHT/ORN)
	2	TXS+ (ORN/WHT)
	28	EB (WHT/GRN)
	3	EA (GRN/WHT)
	29	MB (WHT/BRN)
	4	MA (BRN/WHT)
	30	RXA- (RING) (WHT/SLT)
	5	RXA+ (TIP) (SLT/WHT)
	31	TXA- (RED/BLU)
	6	TXA+ (BLU/RED)
	32	RXS- (RED/ORN)
	7	RXS+ (ORN/RED)
	33	TXS- (RED/GRN)
	8	TXS+ (GRN/RED)
	34	EB (RED/BRN)
	9	EA (BRN/RED)
	35	MB (RED/SLT)
	10	MA (SLT/RED)
	36	RXA- (RING) (BLK/BLU)
	11	RXA+ (TIP) (BLU/BLK)
	37	TXA- (BLK/ORN)
	12	TXA+ (ORN/BLK)
	38	RXS- (BLK/GRN)
	13	RXS+ (GRN/BLK)
	39	TXS- (BLK/BRN)
	14	TXS+ (BRN/BLK)
	40	EB (BLK/SLT)
	15	EA (SLT/BLK)
	41	MB (YEL/BLU)
	16	MA (BLU/YEL)
	42	RXA- (RING) (YEL/ORN)
	17	RXA+ (TIP) (ORN/YEL)
	43	TXA- (YEL/GRN)
	18	TXA+ (GRN/YEL)
	44	RXS- (YEL/BRN)
	19	RXS+ (BRN/YEL)
	45	TXS- (YEL/SLT)
	20	TXS+ (SLT/YEL)
	46	EB (VIO/BLU)
	21	EA (BLU/VIO)
	47	MB (VIO/ORN)
	22	MA (ORN/VIO)
	48	RXA- (RING) (VIO/GRN)
	23	RXA+ (TIP) (GRN/VIO)
	49	TXA- (VIO/BRN)
	24	TXA+ (BRN/VIO)
	50	NC (VIO/SLT)
	25	NC (SLT/VIO)

Figure 23-16 TELEPHONE TERMINAL BLOCK LAYOUT

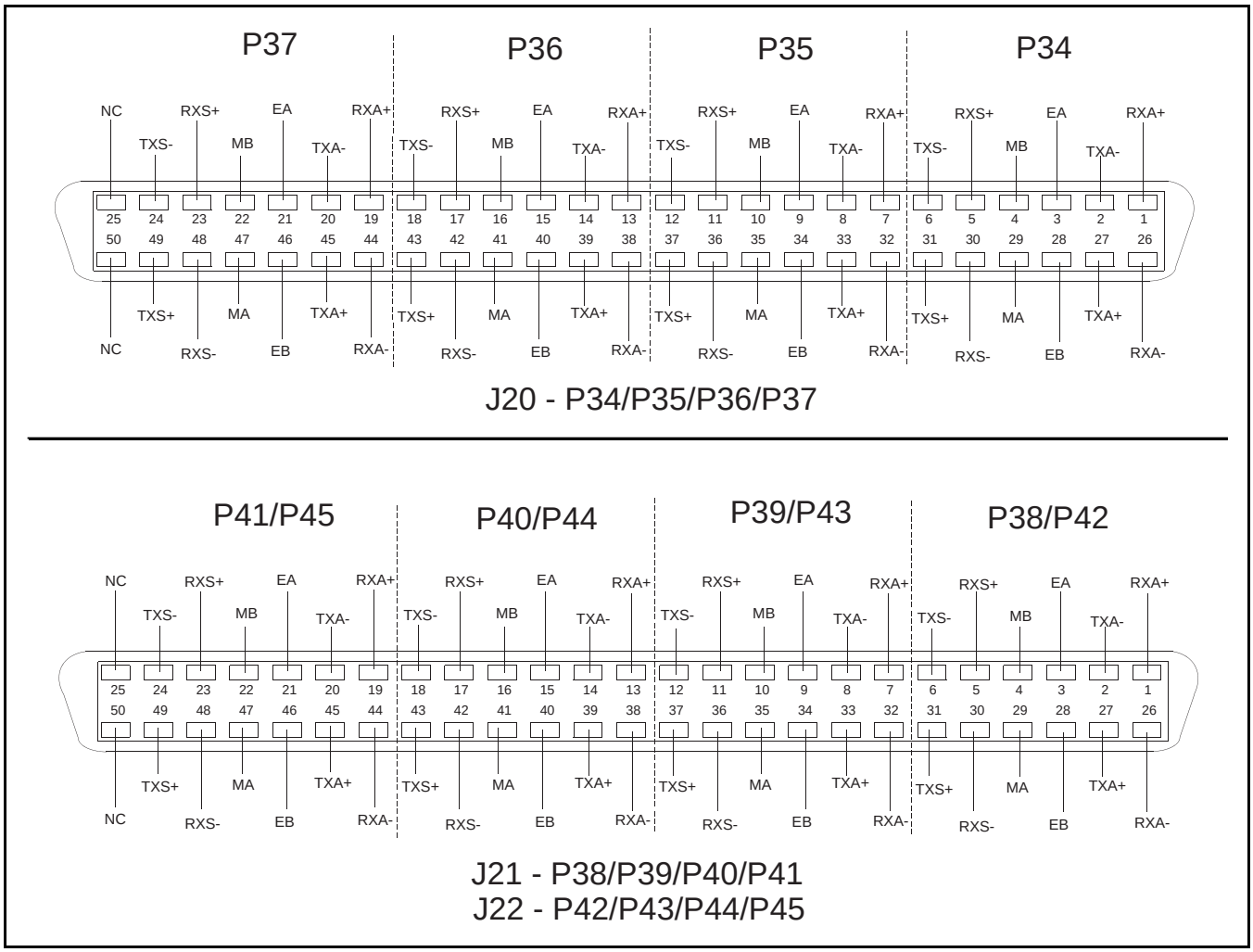


Figure 23-17 BACKPLANE I/O JACKS

SECTION 24 INTERCOM

24.1 DESCRIPTION

The intercom functions as an interface between the Switch and remote base station to aid in alignment of the system. The intercom allows technicians to communicate between the Switch and remote base station over one line pair while aligning a second pair. Then the lines are switched to align the first pair.

24.2 INSTALLATION

24.2.1 EQUIPMENT REQUIRED

1. Audio Oscillator, 600 ohm output

2. AC Voltmeter, HP400E or equivalent

24.2.2 INSTALLATION PROCEDURE

1. Insert the Switch Intercom in an open slot in a card rack. Shelf-1, Slot-3 is preferred.

2. Insert a 1 kHz tone at 0 dBm into the Rx portion of J702.

3. Verify 0 dBm ±1dB at U701, pin 7.

4. Insert the speaker/microphone in jacks J701 and J702.

5. Adjust R704 for maximum level out. (8V P-P across speaker jack J701).

6. Remove the tone.

7. Speak into the microphone in a normal voice and adjust R712 for -12 dBm ±3 dB at U703, pin 1.

8. Use the patch cord cables supplied in the installation kit to patch from the Intercom RX to RX jacks to the transmit and receive jacks on the selected module (CIM). (Refer to VTM component layout.)

9. Adjust the volume knob on the front panel to the desired listening level.

NOTE: J703 can be jumpered on pins 1 and 2 to provide a 600 ohm load to the receiving line. The jumper may be placed on one pin only to provide a high impedance bridging input (refer to the component layout).

This page intentionally left blank.

APPENDIX A ERROR MESSAGES

A.1 IDB ERROR MESSAGES TO MESSAGE ACCOUNTING BUS FROM MODULES

MESSAGE	CODE	DESCRIPTION
RPTASGNERR	1	Repeater Assignment Error from Repeater Interface Module
LNKSTUPTO	2	Link Setup Time-out on Channel Interface Bus
RPTRESTRT	3	Repeater Restarted Unexpected from Repeater Interface Module
ERONRM	4	Enable Repeater Order No Response Message
DRONRM	5	Disable Repeater Order No Response Message
RECWMSG	6	Received Wrong Message from the Repeater Interface Module
TXCRNRM	7	Xmit Call Req. No Resp. from the Repeater Interface Module
NOCHACK	8	No Channel Acknowledge from the Repeater Interface Module
NTCAM	9	No Transmit Call Acknowledge from the Repeater Interface Module
NTHAM	10	No Transmit Hang Acknowledge from the Repeater Interface Module
NTCLAM	11	No Transmit Clear Acknowledge from the Repeater Interface Module
NRXUPD	12	No Receive Update from the Repeater Interface Module
EXTERR	13	External Error
GRPNUMERR	14	Group Number Error
IDLE BUSY	15	Idle Busy Conflict
TXTIMOUT	16	Transmit Time-out Error
HANGERR	17	Hang Error
NRAAM	18	No Repeater Authorization Acknowledge Message
NOTRUNK	19	Telephone Interface Module No Trunk Error
SNMCONNERR	20	System Network Module Connection Failure
LEMNRO	21	Link Established Message - No Response Order
REMNRO	22	Repeater Enabled Message No Response Order
RDMNRO	23	Repeater Disabled message No Response Order
ELDLOST	24	Loss of E-Lead on the Pulse Code Modulation
NOSMMRESP	25	No Response from the Network System Management Module
NOMODRESP	26	No Response from the Module
NOTRNKRO	27	No Trunk Response Order
NODISCRSP	28	No Disconnect Response
NODIMRESP	29	No Dispatch Interface Module Response
NOSNBRESP	30	No System Network Bus Response
NOSERV	31	2-Way Not Able To Get Service
NODTONE	32	No Dial Tone Received
NOWINK	33	No Wink Received
NOTRUNK2WY	34	No Trunk Connected To 2-Way
REG LOSE	35	Lost A Registration Request Message
RIMLNKLOST	36	Repeater Interface Module Link Lost
CRVMSTAT	37	CRVM Status - Data 2 0 = Good, 1 = Fail
CIMSTANDY	38	CIM went to Standby
SNMLINKUP	39	SNM SNB link restored
NOIDIBRESP	40	IDM and Console link lost
IDIBACTIVE	41	IDM and Console link back
IDBLOCK	72	Intra-Terminal Data Bus Lockup
CSBLOCK	73	Channel Status Bus Lockup
NIMLOCK	74	Network Interface Module Lockup

A.2 MAB ERROR MESSAGES FROM SYSTEM MANAGEMENT MODULE

MESSAGE	CODE	DESCRIPTION
NO_MEM	100	Out of Memory
BAD_ADRS	101	Received Card Address Out of Range
CLK_STAT	102	Clock Status
CLK_TKVR	103	Clock Takeover
UNEXP_DIM	104	Unexpected Dispatch Interface Module Acknowledge
DIM_INIT	105	Dispatch Interface Module Initialization Complete
DEV_ENAB	106	Device Enabled
CIM_INIT	107	Channel Interface Module Initialization Complete
RESERVED	108	
CCM_INIT	109	Conventional Channel Module Initialized
SNM_INIT	110	System Network Module Initialized
DEVNOTDEF	111	Device Not Defined at Initialization
RPTR_ENA	112	Repeater Enable
RPTR_DIS	113	Repeater Disabled
UID_TERM	114	Unique Identification Terminated
UNEXPTRM	115	Unexpected Unique Identification Termination
UID_RSGN	116	Unique Identification Reassigned
FAIL_TRM	117	Failed Terminate Set Up
FAIL_INT	118	Failed Interrogate Set Up
SIDRMTO	119	Selected Unit Disable Time-out
NRSPSAO	120	No Response Suspend Audio Order
FAIL_DYN	121	Failed Dynamic Reassignment Setup
DRRMTO	122	Dynamic Reassignment Response Time-out
SUDFAIL	123	No Acknowledge to Selective Reassignment Order
SUDEXEFAIL	124	Execute Selective Unit Disable Failure
DYNEXEFAIL	125	Fail Execute of Dynamic Reassignment
UEXPDYNR	126	Unexpected Dynamic Reassignment
SYS_BOOT	127	System Boot Complete
SUDCFAIL	128	Call Failure Prior to Selective Unit Disable
REGOFAIL	129	Radio Network Terminal Registration Out to Others Failure
DIMRQFAIL	130	No Response for Dispatch Interface Module to accept a Unique Identification Call
SNMRQFAIL	131	No Response for System Network Module to Accept a Unique Identification Call
MAXDSC	132	Exceeded Number of Tries to Disconnect Device
IDLERROR	133	Pointer Indicate Idle and Still on Timed List
SNMIDLERR	134	System Network Module Idle Time-out Error
TIM_INIT	135	Telephone Interface Module Initialization
NOTRKRSPSTR	136	No Telephone Interface Module Response to Trunk Request
TIMIDLERR	137	Telephone Interface Module Idle Time-out Error
NAKTRNKREQ	138	No Acknowledge to a Telephone Interface Module Outgoing Request
TIMACKFAIL	139	No Response to Call Destination Order
DIMACKFAIL	140	No Response to Call Destination Order
SNMACKFAIL	141	No Response to Call Destination Order
DYNEXENACK	142	No Acknowledge of Dynamic Reassignment by Mobile
ENABLEFAIL	143	Failure to Complete Enable of Card
SA_NOCIMRE	144	System Analyzer No Channel Interface Module Response
SA_LSTCHNL	145	System Analyzer Fail As Last Channel - Stopped Check Channel Still "ON THE AIR"

MESSAGE	CODE	DESCRIPTION
SA_NODETRM	146	System Analyzer Fail No Determination - Continue Checking
SA_TESTMOB	147	System Analyzer Test Mobile Failure
SA_CHNFAIL	148	System Analyzer Channel Failure
SA_BUSYOUT	149	System Analyzer Exceed Multiple Unique Identification Busy Count
SA_CHKIDLE	150	System Analyzer Exceed Busy Resolve Time-out
DCM_INIT	151	Dispatch Channel Module Initialization
SUDRADDSBL	152	Selective Unit Disable Kill Not Allowed by Radio
RMF_LOGIN	153	A Remote Management Facility Login
RMF_LOGOUT	154	A Remote Management Facility Logout
VDM_INIT	155	VDM Initialization
NO_QSETUP	159	No Queue setup completion message
IDM_INIT	160	IDM Initialization
LEM_INIT	161	LEM Initialization
DF_NOCIMRE	162	Dyn. Freq. No CIM Response
GPM_IDMFAIL	163	IDM failed to acknowledge patch setup
GPM_ADFAIL	164	GPM failed to acknowledge patch add order
GPM_RCFAIL	165	GPM failed to acknowledge reconfiguration order

This page intentionally left blank.

APPENDIX B CALL SEQUENCES

B.1 GROUP CALL

B.1.1 MOBILE TO MOBILE ON SAME SITE

Use two mobiles with the same Home and list of Group IDs. Select the same Group on the mobiles.

1. Press the PTT on Mobile-1.

   - The CIM associated with the active repeater changes from Idle Task '2' to Receive Task "4".
   - Mobile-2 receives the voice communication from Mobile-1.
   - No DIMs receive voice communication.

2. Release the PTT on Mobile-1.

   - The active CIM returns to the Idle Task "2".
   - Mobile-2 returns to Idle and is silent.

3. Repeat these steps using Mobile-2 as PTT Mobile.

B.1.2 MOBILE TO MOBILE WITH DIM MONITORING

Use two mobiles with the same Home and list of Group IDs. On the Dispatch Console (DC) select a DIM and mobiles with a group that is common to both.

1. Press the PTT on Mobile-1.

   - The CIM associated with the active repeater changes from Idle Task "2" to Receive Task "4".
   - The associated DIM changes from Idle Task "2" to Receive Task "4".
   - The DIM receives the voice communication.
   - Mobile-2 receives the voice communication from Mobile-1.

2. Release the PTT on Mobile-1.

   - The CIM returns to Idle Task "2".
   - Mobile-2 returns to Idle and is silent.
   - The DIM returns to Idle Task "2" and no voice communication is heard at the DC.

3. Repeat these steps using Mobile-2 as PTT Mobile.

B.2 DISPATCH CONSOLE (DC) TO MOBILE GROUP CALL

Use two mobiles with the same Home and list of Group IDs. Select the DIM that contains this Group ID.

1. Press the PTT function on the DC.

   - The associated DIM changes from the Idle Task "2" to the Transmit Task "3".
   - The Associated CIM is selected and changes from the Idle Task "2" to Transmit Task "3".
   - The mobiles receive the voice communication.

2. Release the PTT on the DC.
   - The associated DIM returns to Idle Task "2".
   - The associated CIM returns to Idle Task "2".
     If the associated DIM has Hang Time defined, the associated CIM enters Hang Task "7" for the defined time.
     When the Hang Time has expired the associated CIM returns to Idle Task "2".
   - The mobiles return to idle and stop receiving.

B.3 MOBILE GROUP CALL TO DISPATCH CONSOLE

Use two mobiles with the same Home and list of Group IDs. On the Dispatch Console (DC) select a DIM and mobiles with a group that is common to both.

1. Press the PTT on Mobile-1.

   - The CIM associated with the active repeater changes from Idle Task "2" to Receive Task "4".
   - The associated DIM changes from Idle Task "2" to Receive Task "4".
   - The DIM receives the voice communication.
   - Mobile-2 receives the voice communication.

2. On the DC press the PTT of the DIM.

   - The associated DIM changes to Transmit Task "3".
   - The associated DIM changes to Duplex Task "6".

- Mobile-2 receives voice communication from both the DC and Mobile-1.

3. Release the PTT of Mobile-1.
   - The associated CIM changes to Transmit Task “3”.
   - Both mobiles now receive the DIM voice communication.
     If the associated DIM has Hang Time defined, the associated CIM enters Hang Task “7” for the defined time.
     When the Hang Time has expired the associated CIM returns to Idle Task “2”.
   - The mobiles return to idle and are silent.

B.4 MOBILE TO UNIQUE ID

Use two mobiles defined to different Home and Group ID.

NOTE: Some of these tasks change rapidly.

1. Mobile-1, the originating mobile, selects the Auxiliary Call group code.

2. Press the PTT of Mobile-1 to access the system.

   - Originating CIM (O-CIM), changes from Idle Task “2” to Dial Tone Task “C”.

3. Release the PTT of Mobile-1.

   - Mobile-1 hears “Dial Tone” from O-CIM.

4. Press the PTT of Mobile-1.

5. When Mobile-1's transmit light is lit, enter 4-digits of DTMF for the Unique ID of Mobile-2 (terminating mobile).

6. Release the PTT of Mobile-1.

   - Mobile-1 hears the “Confirmation Tone” from the O-CIM confirming the acceptance of the digits.
   - O-CIM changes to the Ringing Task “D”.
   - Mobile-1 hears “Ringing Tone” from the O-CIM.
   - Originating SNM (O-SNM) changes from Idle Task “2” to SNM Outgoing Task “8”.
   - Destination SNM (D-SNM) changes from Idle Task “2” to incoming Seize Task “3”.
   - D-SNM changes from Incoming Seize Task “3” to SNM Incoming Task “4”.
   - D-SNM changes to Incoming Channel Task “5”.
   - O-SNM changes to Outgoing Channel Task “9”.
   - Destination CIM (D-CIM) changes from Idle Task “2” to Transmit Task “3”.
   - Mobile-2 hears “Ringing Tone”.

7. Press the PTT on Mobile-2.

   - D-CIM changes to Duplex Task “6”.
   - O-CIM changes to Transmit Task “3”.
   - Mobile-1 hears the voice of Mobile-2.

8. Release the PTT on Mobile-2.

   - D-CIM changes to Transmit Task “3”.
   - Mobile-1 is silent.

9. Press the PTT on Mobile-1.

   - O-CIM changes to Duplex Task “6”.
   - Mobile-2 hears the voice of Mobile-1.

10. Release the PTT on Mobile-1.

    - O-CIM changes to transmit Task “3”.
    - Mobile-2 is silent.

11. Press the PTT on Mobile-1.

12. Press DTMF “#” key for longer than 1 second.

    - O-CIM changes to the End Call Task “E”.
    - Mobile-1 hears the “End Call Tone”.
    - O-CIM changes to Idle Task “2”.
    - O-SNM changes to the Idle Task “2”.
    - D-SNM changes to the End Call Task “C”.
    - D-CIM changes to the End Call Task “E”.
    - Mobile-2 hears the “End Call Tone”.
    - D-CIM changes to the Idle Task “2”.
    - D-SNM changes to the Idle Task “2”.

B.5 MOBILE TO UNIQUE ID FOR A MOBILE OUTSIDE SWITCH

Use two mobiles defined to different Home and Group ID.

NOTE: Some of these tasks change rapidly.

1. Mobile-1, the originating mobile, selects the Auxiliary Call group code.

2. Press the PTT of Mobile-1 to access the system.

   - The originating CIM (O-CIM), changes from Idle Task “2” to Dial Tone Task “C”.

3. Release the PTT of Mobile-1.

   - Mobile-1 hears “Dial Tone” from O-CIM.

4. Press the PTT of Mobile-1.

5. When Mobile-1's transmit light is lit, Enter 7-DTMF digits, 3 for site outside the Switch and 4 for the Unique ID of Mobile-2 (terminating mobile.

6. Release the PTT of Mobile-1.

   - Mobile-1 hears the “Confirmation Tone” from the O-CIM confirming the acceptance of the digits.
   - O-CIM changes to the Ringing Task “D”.
   - Mobile-1 hears “Ringing Tone” from the O-CIM.
   - Originating SNM (O-SNM) changes from Idle Task “2” to SNM Outgoing Task “8”.
   - Destination SNM (D-SNM) changes from Idle Task “2” to incoming Seize Task “3”.
   - D-SNM changes from Incoming Seize Task “3” to SNM Incoming Task “4”.
   - D-SNM changes to Incoming Channel Task “5”.
   - O-SNM changes to Outgoing Channel Task “9”.
   - Destination CIM (D-CIM) changes from Idle Task “2” to Transmit Task “3”.
   - Mobile-2 hears “Ringing Tone”.

7. Press the PTT on Mobile-2.

   - D-CIM changes to Duplex Task “6”.
   - O-CIM changes to Transmit Task “3”.
   - Mobile-1 hears the voice of Mobile-2.

8. Release the PTT on Mobile-2.

   - D-CIM changes to Transmit Task “3”.
   - Mobile-1 is silent.

9. Press the PTT on Mobile-1.

   - O-CIM changes to Duplex Task “6”.
   - Mobile-2 hears the voice of Mobile-1.

10. Release the PTT on Mobile-1.

    - O-CIM changes to transmit Task “3”.
    - Mobile-2 is silent.

11. Press the PTT on Mobile-1.

12. Press DTMF “#” key for longer than 1 second.

    - O-CIM changes to the End Call Task “E”.
    - Mobile-1 hears the “End Call Tone”.
    - O-CIM changes to Idle Task “2”.
    - O-SNM changes to the Idle Task “2”.
    - D-SNM changes to the End Call Task “C”.
    - D-CIM changes to the End Call Task “E”.
    - Mobile-2 hears the “End Call Tone”.
    - D-CIM changes to the Idle Task “2”.
    - D-SNM changes to the Idle Task “2”.

B.6 MOBILE TO DIRECTED GROUP CALL (DTMF ENTRY WITHIN SWITCH)

Use two mobiles defined to different Home and Group ID.

NOTE: Some of these tasks change rapidly.

1. Mobile-1, the originating mobile, selects the Auxiliary Call group code.

2. Press the PTT of Mobile-1 to access the system.

   - The originating CIM (O-CIM), changes from Idle Task “2” to Dial Tone Task “C”.

3. Release the PTT of Mobile-1.

   - Mobile-1 hears “Dial Tone” from O-CIM.

4. Press the PTT of Mobile-1.

5. When Mobile-1's transmit light is lit, enter DTMF digits:

   - Enter 5-DTMF digits, 2 for Home channel and 3 for the Group ID desired.
   - Enter 8-DTMF digits, 3 for different site within Switch, 2 for Home channel and 3 for Group ID desired.

6. Release the PTT of Mobile-1 to indicate completion of dialing.

   - O-CIM hears the “Confirmation Tone”.
   - Originating SNM (O-SNM) changes to SNM Outgoing Task “8”.
   - Destination SNM (D-SNM) changes to Incoming Seize Task “3”.
   - D-SNM changes to Incoming Task “4”.
   - Destination CIM (D-CIM) changes to Transmit Task “3”.
   - D-SNM changes to Incoming Channel Task “5”.
   - O-SNM changes to Outgoing Channel Task “9”.
   - O-CIM changes to Ringing Task “D”.
   - Mobile-1 hears the “Call Proceed Tone”.

7. Press the PTT on Mobile-1.

   - O-CIM changes to Receive Task “4”.
   - D-CIM changes to Transmit Task “3”.
   - Mobile-2, destination mobile, hears Mobile-1 voice communication.

8. Release the PTT on Mobile-1.

   - O-CIM changes to Hang Task “7”.
   - D-CIM changes to Hang Task “7”.
   - Mobile-2 is silent.

9. Press the PTT on Mobile-2.
   - D-CIM changes to Receive Task “4”.
   - O-CIM changes to Transmit Task “3”.
   - Mobile-1 hears the voice of Mobile-2.

10. Release the PTT on Mobile-2.

    - D-CIM changes to Hang Task “7”.
    - O-CIM changes to Hang Task “7”.
    - Mobile-1 is silent.

11. Press the PTT on Mobile-1.

    - O-CIM changes to Receive Task “4”.
    - D-CIM changes to Transmit Task “3”.
    - Mobile-2 hears the voice of Mobile-1.

12. Press DTMF “#” key for longer than 1 second.

    - O-CIM changes to the End Call Task “E”.
    - Mobile-1 hears the “End Call Tone”.
    - O-CIM changes to Idle Task “2”.
    - Both SNMs change to the End Call Task “C”.
    - D-CIM changes to the End Call Task “E”.
    - Mobile-2 hears the “End Call Tone”.
    - D-CIM and both SNMs change to the Idle Task “2”.

B.7 MOBILE TO DIRECTED GROUP CALL (DTMF ENTRY OUTSIDE THE SWITCH)

Use two mobiles defined to different Home and Group ID.

NOTE: Some of these tasks change rapidly.

1. Mobile-1, the originating mobile, selects the Auxiliary Call group code.

2. Press the PTT of Mobile-1 to access the system.

   - Originating CIM (O-CIM), changes from Idle Task “2” to Dial Tone Task “C”.

3. Release the PTT of Mobile-1.

   - Mobile-1 hears “Dial Tone” from the O-CIM.

4. Press the PTT of Mobile-1.

5. When Mobile-1's transmit light is lit, enter DTMF digits:

   - Enter 5-DTMF digits, 2 for Home channel and 3 for the Group ID desired.
   - Enter 8-DTMF digits, 3 for different sites within Switch, 2 for Home channel and 3 for Group ID desired.

6. Release the PTT of Mobile-1 to indicate completion of dialing.

   - O-CIM hears the “Confirmation Tone”.
   - Originating SNM (O-SNM) changes to SNM Outgoing Task “8”.
   - Destination SNM (D-SNM) changes to Incoming Seize Task “3”.
   - D-SNM changes to Incoming Task “4”.
   - Destination CIM (D-CIM) changes to Transmit Task “3”.
   - D-SNM changes to Incoming Channel Task “5”.
   - O-SNM changes to Outgoing Channel Task “9”.
   - O-CIM changes to Ringing Task “D”.
   - Mobile-1 hears the “Call Proceed Tone”.

7. Press the PTT on Mobile-1.

   - O-CIM changes to Receive Task “4”.
   - D-CIM changes to Transmit Task “3”.
   - Mobile-2, destination mobile, hears Mobile-1 voice communication.

8. Release the PTT on Mobile-1.

   - O-CIM changes to Hang Task “7”.
   - D-CIM changes to Hang Task “7”.
   - Mobile-2 is silent.

9. Press the PTT on Mobile-2.

   - D-CIM changes to Receive Task “4”.
   - O-CIM changes to Transmit Task “3”.
   - Mobile-1 hears the voice of Mobile-2.

10. Release the PTT on Mobile-2.

    - D-CIM changes to Hang Task “7”.
    - O-CIM changes to Hand Task “7”.
    - Mobile-1 is silent.

11. Press the PTT on Mobile-1.

    - O-CIM changes to Receive Task “4”.
    - D-CIM changes to Transmit Task “3”.
    - Mobile-2 hears the voice of Mobile-1.

12. Press DTMF “#” key for longer than 1 second.

    - O-CIM changes to End Call Task “E”.
    - Mobile-1 hears the “End Call Tone”.
    - O-CIM changes to Idle Task “2”.
    - Both SNMs change to End Call Task “C”.
    - D-CIM changes to End Call Task “E”.
    - Mobile-2 hears “End Call Tone”.
    - D-CIM and both SNMs change to Idle Task “2”.

B.8 MOBILE ORIGINATED TELEPHONE CALL

1. Mobile selects the Telephone Call group code.

2. Press the mobile's PTT to access the system.

   - The associated CIM changes from Idle Task “2” to Dial Tone Task “C”.

3. Release the PTT of the mobile.

   - Mobile hears “Dial Tone” from the CIM.

4. Press the PTT of the mobile.

5. When the transmit light of the mobile is lit, enter DTMF digits.

   - When the Call Processor is set for normal dialing translation, enter the required digits to exercise the dialing translation function.
   - When the Call Processor is set for PBX operation, enter the complete set of digits, no wait for second dial tone after the access digits.

6. Release the PTT of the mobile.

   - CIM hears the “Confirmation Tone”.
   - TIM changes from Idle Task “2” to TIM Outgoing Task “8”.
   - When digit dialing is complete, the TIM changes to Channel Conversation Task “9”.
   - CIM changes to Ringing Task “D”.
   - Mobile hears landside progress tones, ringing, busy or called party answer.

7. Press the PTT on the mobile.

   - CIM changes to Duplex Task “6”.
   - Called party hears the mobile voice.

8. Release the PTT on the mobile.

   - CIM changes to Transmit Task “3”.
   - Mobile hears the called party.

- Called party does not hear the mobile.

9. Press the PTT on the mobile.

   - CIM changes to Duplex Task “6”.
   - Called party hears the mobile voice.

10. Press the DTMF “#” key for longer than 1 second and release the PTT.

    - CIM changes to End Call Task “E”.
    - Mobile hears the “End Call Tone”.
    - CIM changes to Idle Task “2”.
    - Mobile returns to idle and is silent.
    - TIM changes to End Call Task “C”.
    - TIM disconnects the telephone line.
    - TIM changes to Idle Task “2”.

B.9 LANDSIDE (TIM) ORIGINATE TO MOBILE WITHIN SWITCH USING A DID LINE

1. Dial the desired number for a mobile within the Switch.

   - The associated TIM changes from Idle Task “2” to Incoming Seize Task “3”.
   - CIM changes from Idle Task “2” to Transmit Task “3”.
   - TIM changes to Incoming Channel Conversation Task “5”.
   - Landside party and mobile hear “Ringing Tone”.

2. Press the PTT on the mobile.

   - “Ringing Tone” is turned off.
   - CIM changes to Duplex Task “6”.
   - Landside party hears the mobile voice.

3. Release the PTT on the mobile.

   - Landside party hears silence.
   - CIM changes to Transmit Task “3”.
   - Mobile hears the landside party.

4. The mobile disconnects by pressing the PTT and DTMF “#” key for 1 second.

5. The landside party disconnects by pressing the DTMF “#” key for 1 second.

   - CIM changes to the End Call Task “E”.
   - Mobile hears the “End Call Tone”.
   - CIM changes to the Idle Task “2”.
   - Mobile is silent.
   - TIM changes to end Call Task “C”.
   - Landside party hears “End Call Tone”.
   - TIM disconnects the telephone line when landside disconnects.
   - TIM changes to Idle Task “2”.

B.10 LANDSIDE (TIM) ORIGINATE TO MOBILE WITHIN SWITCH USING A 2WY LINE

1. Dial the desired number for the 2WY line.

   - The associated TIM changes from Idle Task “2” to Incoming Seize Task “3”.
   - Landside party hears the proceed tone.

2. The landside party enters the 4-DTMF digits of the Unique ID of the mobile.

   - CIM changes from Idle Task “2” to Transmit Task “3”.
   - TIM changes to Incoming Channel Conversation Task “5”.
   - Landside party and the mobile hear “Ringing Tone”.

3. Press the PTT on the mobile.

   - “Ringing Tone” is turned off.
   - CIM changes to Duplex Task “6”.
   - Landside party hears the mobile voice.

4. Release the PTT on the mobile.

   - Landside party hears silence.
   - CIM changes to Transmit Task “3”.
   - Mobile hears the landside party.

5. Press mobile's PTT and DTMF “#” key for 1 second or landside party presses the DTMF “#” key for 1 second.

   - CIM changes to the End Call Task “E”.
   - Mobile hears the “End Call Tone”.
   - CIM changes to the Idle Task “2”.
   - Mobile is silent.
   - TIM changes to end Call Task “C”.
   - TIM disconnects the telephone line.
   - TIM changes to Idle Task “2”.

B.11 TIM ORIGINATE TO MOBILE OUTSIDE SWITCH USING A DID LINE

NOTE: Some of these tasks change rapidly.

1. Dial the desired number for a mobile within the Switch.

   - The associated TIM changes from Idle Task “2” to Incoming Seize Task “3”.
   - TIM changes to TIM incoming Task “4”.
   - Originating SNM (O-SNM) changes from Idle Task “2” to Incoming Seize Task “3”.
   - O-SNM changes to SNM Outgoing Task “8”.
   - Destination SNM (D-SNM) changes from Idle Task “2” to Incoming Seize Task “3”.
   - D-SNM changes to SNM Incoming Task “4”.
   - Destination CIM (D-CIM) changes from Idle Task “2” to Transmit Task “3”.
   - D-DNM changes to Incoming Channel Task “5”.
   - O-SNM changes to TIM Outgoing Conversation Task “E”.
   - TIM changes to SNM Incoming Conversation Task “D”.
   - Landside party and the mobile hear “Ringing Tone”.

2. Press the PTT on the mobile.

   - “Ringing Tone” is turned off.
   - CIM changes to Duplex Task “6”.
   - Landside party hears the mobile voice.

3. Release the PTT on the mobile.

   - Landside party hears silence.
   - CIM changes to Transmit Task “3”.
   - Mobile hears the landside party.

4. Mobile disconnects by pressing the PTT and DTMF “#” key for 1 second.

5. Landside party disconnects by pressing the DTMF “#” key for 1 second.

   - CIM changes to the End Call Task “E”.
   - Mobile hears the “End Call Tone”.
   - CIM changes to the Idle Task “2”.
   - Mobile is silent.
   - Both SNMs change to End Call Task “C”.
   - TIM changes to end Call Task “C”.
   - Landside party hears “End Call Tone”.
   - TIM disconnects the telephone line.
   - TIM changes to Idle Task “2”.
   - Both SNMs change to Idle Task “2”.

B.12 LANDSIDE ORIGINATE TO MOBILE OUTSIDE SWITCH USING A 2WY LINE

NOTE: Some of these tasks change rapidly.

1. Dial the desired number for the 2WY line.

   - The associated TIM changes from Idle Task “2” to Incoming Seize Task “3”.
   - TIM changes to TIM Incoming Task “4”.
   - Landside party hears a “Proceed Dialing Tone”.

2. The landside party enters the 4-DTMF digits of the Unique ID of the mobile.

   - CIM changes from Idle Task “2” to Transmit Task “3”.
   - TIM changes to Incoming Channel Conversation Task “5”.
   - Landside party and the mobile hear “Ringing Tone”.

3. Press the PTT on the mobile.

   - “Ringing Tone” is turned off.
   - The CIM changes to Duplex Task “6”.
   - Landside party hears the mobile voice.

4. Release the PTT on the mobile.

   - Landside party hears silence.
   - CIM changes to Transmit Task “3”.
   - Mobile hears the landside party.

5. The mobile press the PTT and DTMF “#” key for 1 second or landside party presses the DTMF “#” key for 1 second.

   - CIM changes to the End Call Task “E”.
   - Mobile hears the “End Call Tone”.
   - CIM changes to the Idle Task “2”.
   - Mobile is silent.
   - TIM changes to end Call Task “C”.
   - TIM disconnects the telephone line.
   - TIM changes to Idle Task “2”.

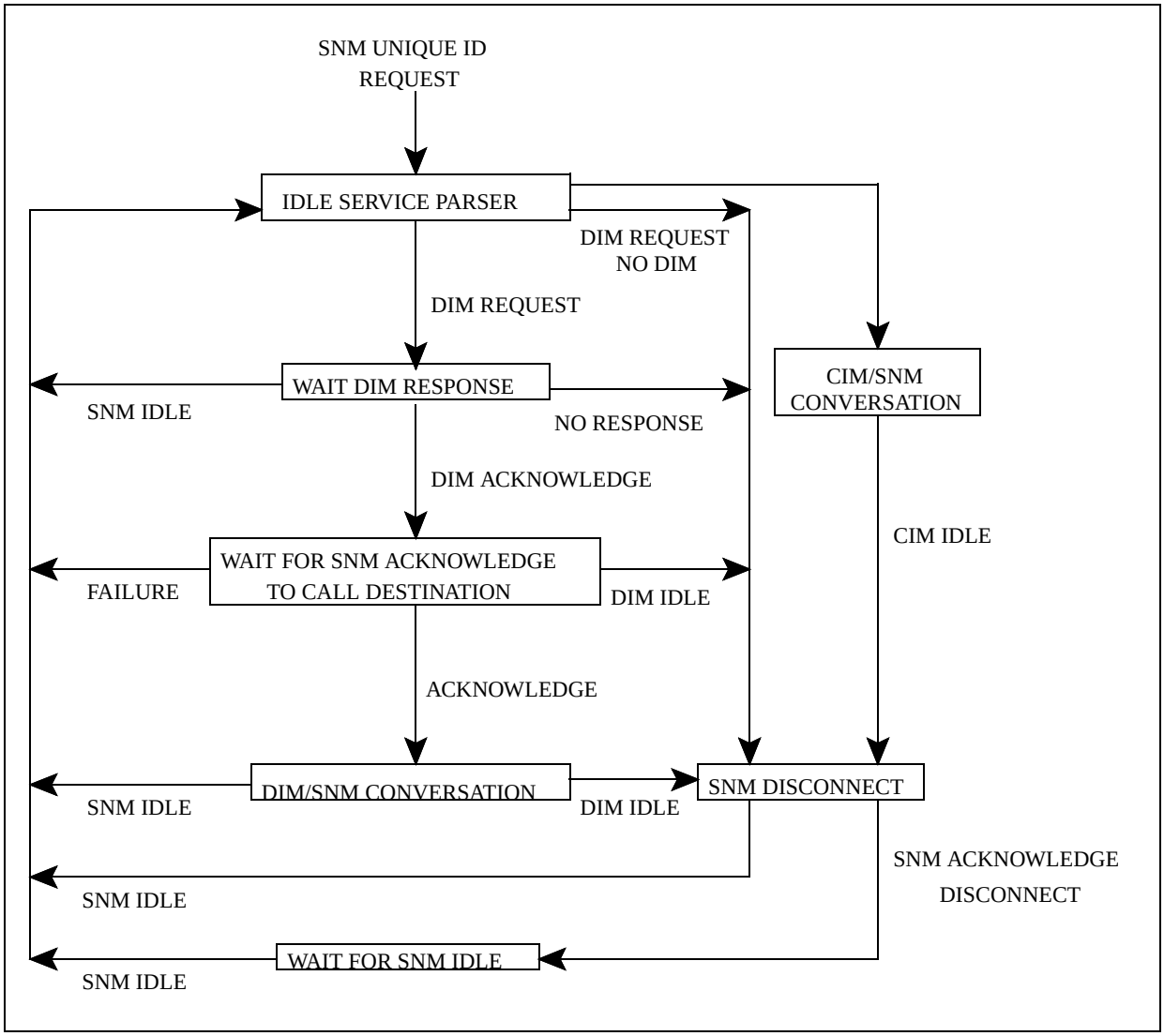


Figure B-1 SNM UNIQUE ID REQUEST FLOWCHART

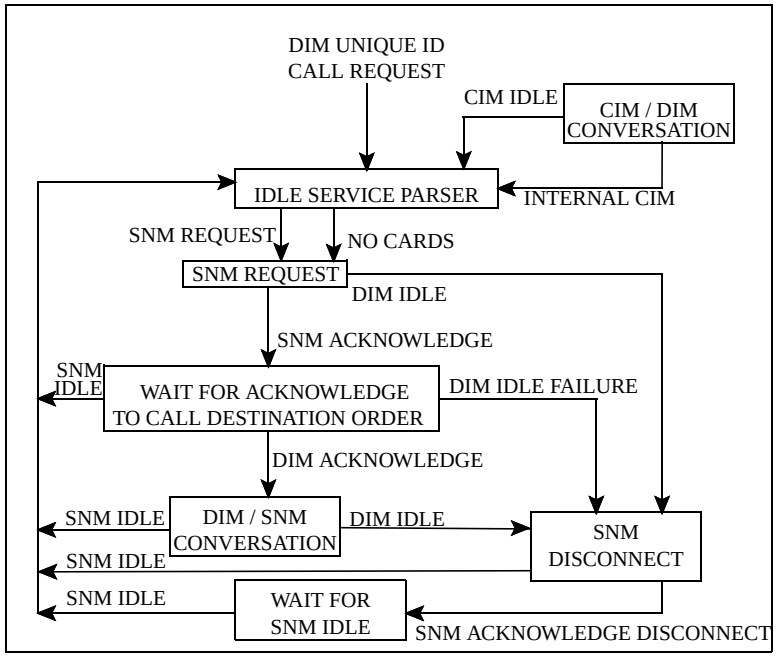


Figure B-2 DIM UNIQUE ID REQUEST FLOWCHART

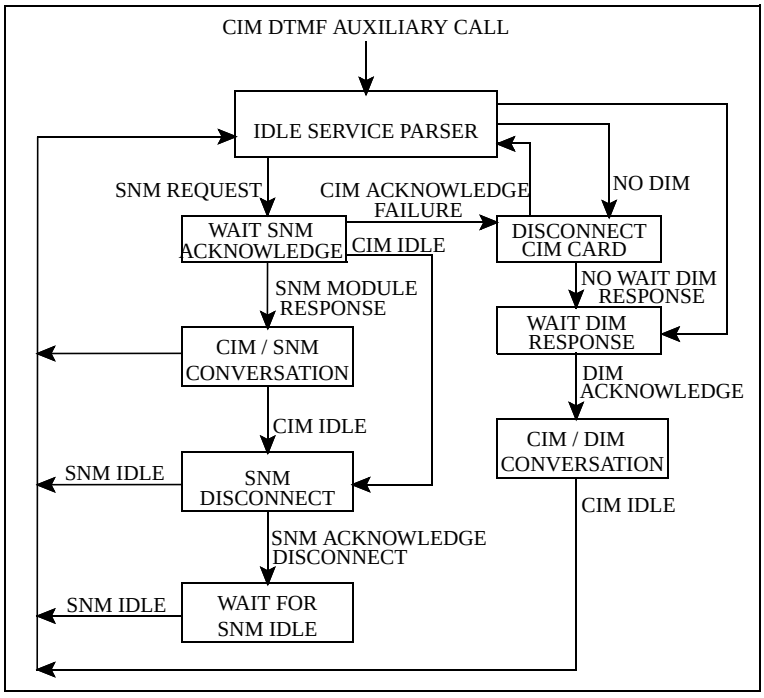


Figure B-3 CIM DTMF AUXILIARY CALL FLOWCHART

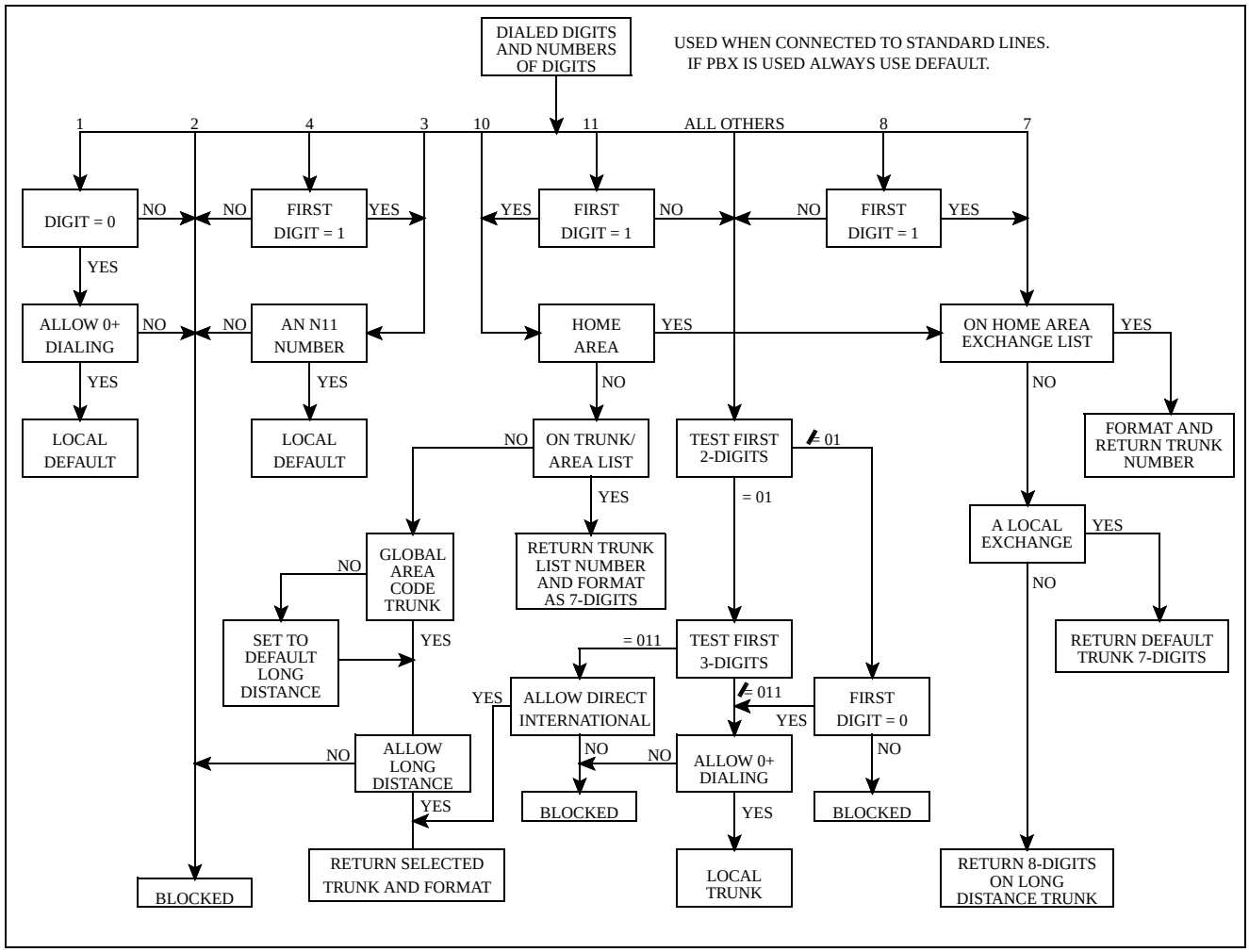


Figure B-4 DIALED DIGITS AND NUMBER OF DIGITS FLOWCHART

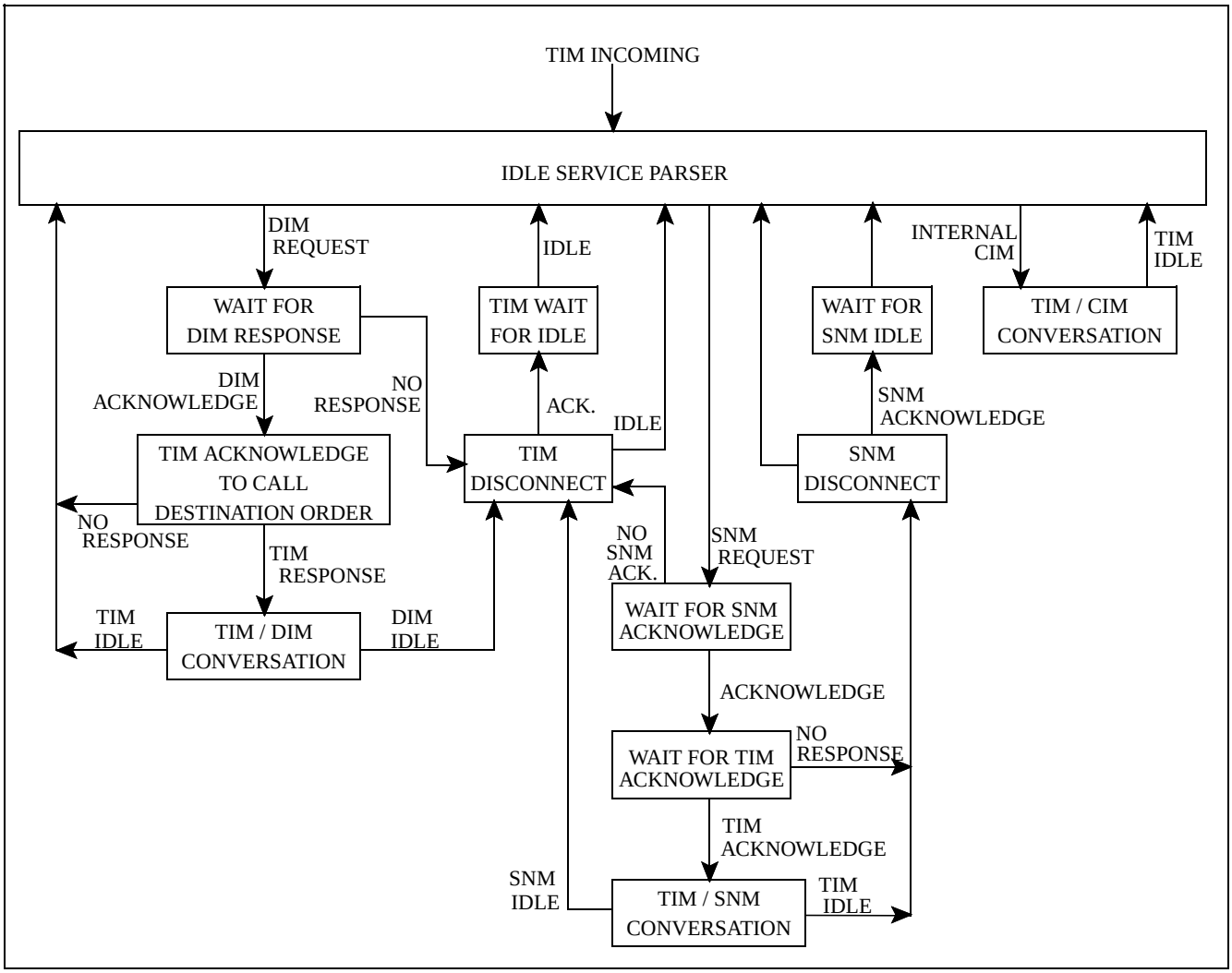


Figure B-5 TELEPHONE TIM INCOMING FLOWCHART

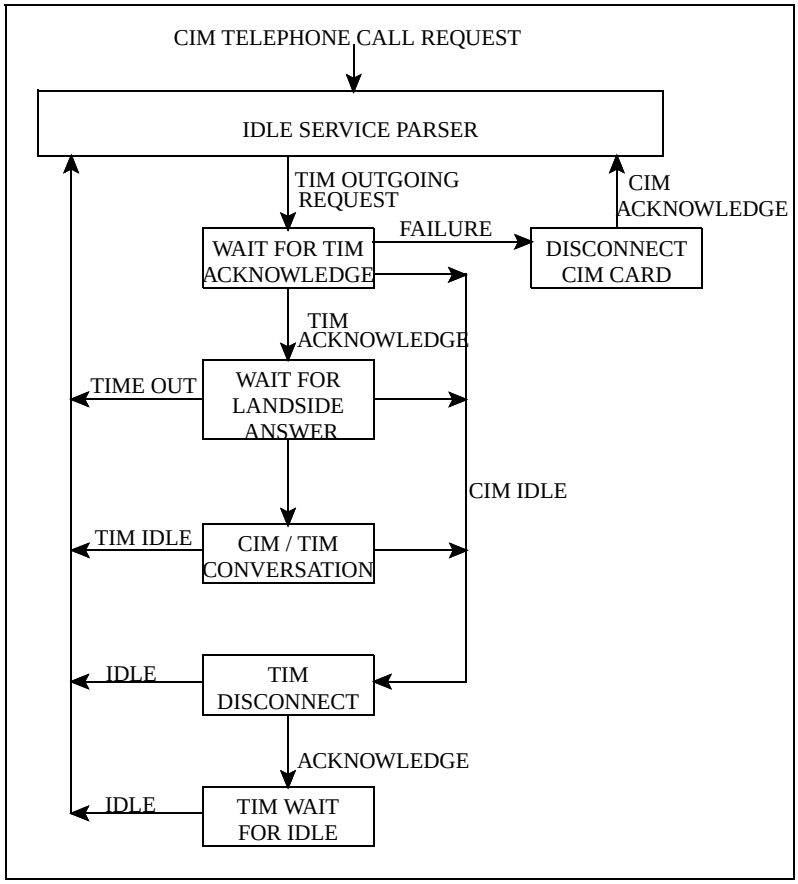


Figure B-6 TELEPHONE CALLING CIM TELEPHONE CALL REQUEST FLOWCHART

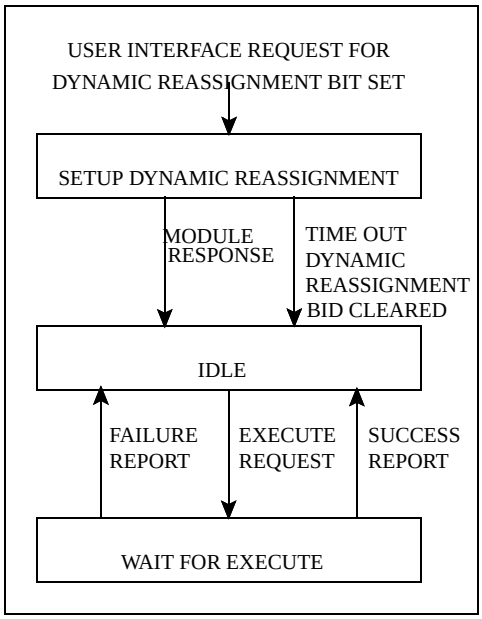


Figure B-7 DYNAMIC REASSIGNMENT USER INTERFACE REQUEST FLOWCHART

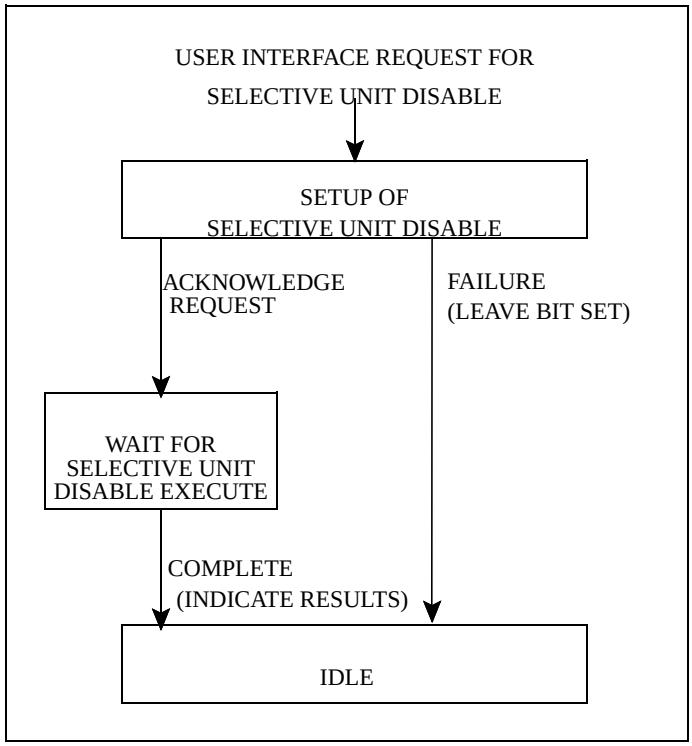


Figure B-8 SELECTIVE UNIT DISABLE USER INTERFACE REQUEST FLOWCHART

Part Number 001-3139-005
10-03 Printed in U.S.A.